Bulletin of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Volume 3, 1924

Edited by the Secretary of the Society, Ross C. Purdy
Assistant Editor, Emily C. Van Schoick
Assisted by Officers of the Industrial Divisions

P. D.

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Vol. 3 — **January, 1924** — **No. 1**

EDITORIALS

WHAT OF 1924?

The twenty-fifth year of service is now history. The mistakes and shortcomings cannot be retrieved. The things accomplished will continue always as benefits to ceramic industries. There is only one sane resolution of purpose for the new year; each officer, committeeman and member will do his share in achieving more in 1924 than has been achieved in any previous year.

The 1923 conventions of the SOCIETY were the most largely attended and of the greatest value. Those of 1924 will exceed those of 1923. The Committees accomplished more in 1923 than in any previous year and they are set for even greater productiveness in 1924. The 1923 *Journal* of original research reports was more voluminous and equal in quality to any previously published and the *Journal* for 1924 promises to be equal to if not surpassing that of 1923.

The abstracts of the world's ceramic literature was progressed in 1923 in quality and scope but the plans for 1924 have been perfected in detail for even more thorough and better abstracting.

The SOCIETY will accomplish in 1924 just what the members shall will it to accomplish. There is no one person nor any group of persons elected or self-appointed who can have an enduring reason or a continued opportunity to make of the SOCIETY anything other than what is profitable to the

majority of the members. The prospects for 1924 are indeed very promising in increased value of services rendered by the SOCIETY.

THE BIG IDEA OF THE AMERICAN CERAMIC SOCIETY

1. The AMERICAN CERAMIC SOCIETY was founded twenty-six years ago by a group of ceramic manufacturers and educators to promote the ceramic arts and sciences. It was chartered under the laws of Ohio as a non-profit sharing corporation for this announced purpose and has continued as such for these twenty-six years.

2. Six years ago it reorganized its procedure by establishing Industrial Divisions and Local Sections, and changing its publication from annual *Transactions* to a monthly *Journal*, and establishing standing committees for Research, Standards, Data, Geological Surveys and Education.

3. The Divisions and Local Sections are self-governing groups each with their own officers and committees. Each Division holds four technical sessions at the Annual Convention thus making these conventions really seven conventions in one.

4. The method of promoting the ceramic arts and science is by (*a*) conventions, (*b*) publications of research reports, (*c*) abstracting of the world's literature, (*d*) preparation of bibliographies, (*e*) assisting research laboratories in the finding of problems, the securing of materials and analyzing the results and (*f*) promoting coöperative research and ceramic educational enterprises.

5. The SOCIETY promotes the making of research contacts by trade associations with established laboratories, and develops collaborations of private industrial laboratories.

6. It organizes research groups of manufacturing concerns for the benefit of the supporting firm members.

7. It carried through the campaigns that resulted in the establishing of ceramic departments in the Federal Bureaus and has promoted the establishing of collegiate ceramic schools.

8. These several activities may be summarized into the one "Big Idea of the Society," that of a strong promoting, reporting and recording research and educational organization of ceramic manufacturers in which all have a common interest and equal rights and benefits.

9. It does not encroach upon nor conflict in purpose with any activity which any trade association or publication has or could undertake. In fact, the constant endeavor is to collaborate with these trade organizations. It does not finance researches, maintain laboratories nor conduct courses of ceramic education. It does not maintain its *Journal* for financial profit.

10. It is said, and we believe truly so, that the conventions and publications of the AMERICAN CERAMIC SOCIETY have been more productive and most effective agents for the dissemination of knowledge of ceramic technology and science. The SOCIETY has been constant in its advocacy of research and technical plant control until today there is a very general appreciation of the value of these as shown by the coöperative researches conducted by trade associations and by the demand in excess of the supply for trained ceramic engineers.

11. We submit that there is an economic value in all industrial ceramic groups supporting this SOCIETY both on account of the many problems that are of common concern and because of the importance of maintaining the strongest possible research promoting and publishing organization devoted altogether to the promotion of the ceramic arts and sciences. The AMERICAN CERAMIC SOCIETY is not commercial either in purpose or procedure. All of its income is spent in service. It is not controlled by any limited interest but is managed by a board of eleven, nominated and elected by its supporting members. Everything possible must be done to meet the expectations of the 1962 persons and 290 corporations who are now supporting the SOCIETY. It is for this reason we are seeking the confidence, support and collaboration of all ceramic persons, concerns and associations.

If you believe that a strong organization of this sort and for the purposes stated is of value you are urged to participate in the work and to invite others to share in its support and in the benefits which accrue.

ACTIVITIES OF THE SOCIETY

THE PRESIDENT'S PAGE

Our Membership Growth

By A. F. Greaves-Walker

There has been no doubting of the value of having one strong and active association such as is the American Ceramic Society, common to all ceramic interests for the exclusive purpose of promoting the technical, scientific and artistic welfare of the ceramic industries.

There has been no questioning of the honor, rights and benefits of membership in such an organization governed as this Society is for, by and of the members.

There has, however, been a questioning of the value of broadcasting the privileges of membership to all ceramic workers. It would be futile to argue the case for it is a demonstrated fact that the more generally peoples are informed the higher will be the plane of excellency in production and the greater will be the returns to all, both materially and in personal comfort and satisfaction. This is true in social and political life. The country in which the opportunities for education and the means of pleasure and comfort are the most generally enjoyed is the most progressive and is the most substantial. This is true in all human activities. It is true in ceramics.

It is sound in practice and in theory for each ceramic group to maintain separate trade organizations. Each has its own peculiar labor and trade problems.

It is practical and certainly most effective in promotion of the technical welfare of each group and of ceramics in general that each trade association engage in coöperative research of their production problems. There is value accruing directly to each trade association group and indirectly to ceramic industries generally in operative institutes and vocational schools. It has been demonstrated that the industries can in these ways do more to produce better ware at lower cost and be more able to keep abreast with competition and quality demands.

The direct returns from technical research and education is an experienced reality. It does not admit of argument and there is no need of demonstration. There is, however, the necessity of bringing each manufacturer to an actuating appreciation of the returns which surely will follow from technical research and education.

We often forget that there would be no amount of technical advance made and very little education had if there were no revealing record made of observations and experiences so that the ideas and findings of each can be tried by several under different conditions and for different purposes until the fundamental principles have been found and demonstrated. The Universities cannot create all the knowledge. They can merely do their bit along with others as a side line to their principal business of training men educationally. It is from records of industrial application that most knowledge is obtained.

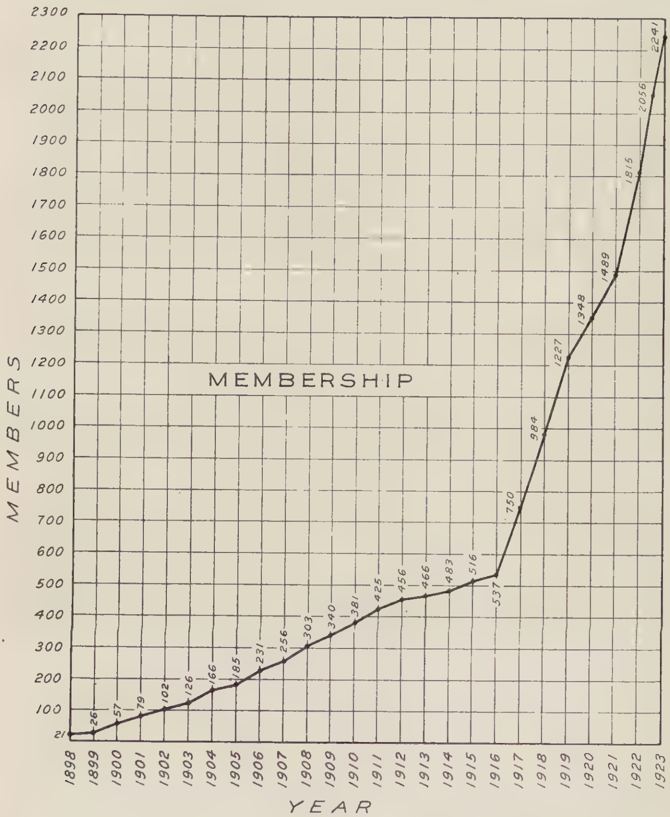
It should be very apparent that it is important to progress of industrial ceramics that there be a common pooling agency for all the ceramic groups such as the American Ceramic Society through and by which knowledge is recorded, abstracted and indexed; and by and through which the several groups contribute their share to the general record of facts and principles. There is an inestimable value to each ceramic concern to have the world's literature abstracted and made available. There is a direct value in committees gathering proved data and finding means of contact with and giving assistance to research agencies in the finding of new facts of immediate importance.

With so much in common technically, there is direct value in all the ceramic groups giving adequate support to a common agency devoted exclusively to the promotional

activities. And it is equally important that the educational benefits of participation in the obtaining and recording of ceramic knowledge shall be extended to every employee and employer who has the capacity and the desire to use knowledge.

The ceramic fraternity generally takes pride and has reason for satisfaction in the growing appreciation of the value of technical research and education and of the need of having a strong organization through which the knowledge from world-wide sources are collected and made known. This growing appreciation is shown by the rapidly growing roster of the AMERICAN CERAMIC SOCIETY.

ARE WE GOING OVER THE TOP?



New Members Received from Nov. 16–Dec. 15

PERSONAL

Robert Burhans, Jr., 607 Pacific Finance Bldg., Los Angeles, Calif., President and Genl. Mgr., Feather-Stone Insulation Co.

Robert R. Busbey, Canton, Ohio, Sales Engineer, The Robinson Clay Product Co., Akron, Ohio.

A. J. Des Lauriers, 311 Chestnut St., St. Paul, Minn., Manufacturer of Milk Cans.

Edwin Burk Estabrook, 4901 Stenton Ave., Philadelphia, Pa., Sales Engineer, Leeds & Northrup Co., Philadelphia, Pa.

Harold Feichter, 209 W. 8th St., Parkersburg, W. Va., with U. S. Roofing Tile Co., Parkersburg, W. Va.

C. Walther Fernholtz, 2053 E. 38th St., Los Angeles, Calif.

Thomas Graham, Box 938, Medicine Hat, Alberta, Canada, Supt., Alberta Clay Products Co., Ltd.

Joseph C. Hearn, President, Saks Stamping Co., Huntington, W. Va.

W. G. Jackson, 258 South Alexandria Ave., Los Angeles, Calif., Manager, Empire China Co., Burbank, Calif.

William G. Jackson, Jr., 258 South Alexandria Ave., Los Angeles, Calif., Empire China Co., Burbank, Calif.

Richard D. Leitch, Asst. Chem. Engr., U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

James H. McCabe, 1758 Central Ave., Cincinnati, O., McCabe Construction Co.

Clarence B. McComas, 1226 Belmont Ave., Baltimore, Md., Chemist, Carr-Lowrey Glass Co.

Wm. E. Magill, Buckwater Stove Co., Royersford, Pa., Mgr., Enamel Dept.

Carl Mehling, 2248 Elmwood Ave., Buffalo, N. Y., Manager, Enamel Department, American Radiator Co.

James G. Moore, 701 Vernon Ave., Long Island City, N. Y., Manager, Peerless Glass Co.

Douglas E. Parsons, 1824 New Hampshire Ave., Washington, D. C., Associate Engineer, Ceramic Division, U. S. Bureau of Standards.

William Pettigrew, 728 Main St., Worcester, Mass., Assistant, Microscopical Division, Research Laboratory, Norton Co., Worcester, Mass.

Frank Piatt, 1495 Franklin Ave., Apt. C, Columbus, Ohio, Salesman, Louisville Fire Brick Works, Louisville, Ky.

Fred Redmond, Pacific Clay Products, Inc., Los Angeles, Calif.

Wm. A. Roffe, Pacific Beach, San Diego, Calif., Secy. and Treas., San Diego Tile & Brick Co.

Olive F. Shults, Alfred, N. Y., Student at State School of Ceramics.

M. A. Snell, 220 Wisconsin Ave., Oak Park, Ill., Chemical Engineer, Ceramics Division, Western Electric Co., Chicago, Ill.

Norman Stein, Bonnybridge, Scotland, Director, John G. Stein & Co., Ltd.

Chas. H. Taylor, McCall, Ky., Mfr. of fire brick and refractories.

Herbert K. Turk, Porcelain Enamel & Mfg. Co., Baltimore, Md.

G. B. Tuthill, 131 West 63 St., Chicago, Ill.

John H. Voorhies, Alfred, N. Y., Student at State School of Ceramics.

Henry Weiss, West Coast Porcelain Mfrs., Millbrae, Calif.

Corporation

The Baltimore Enamel & Novelty Co., P. O. Box No. E-4, Baltimore, Md., Porcelain Enamel Signs, H. B. Little, Vice-president.

The Crossley Machine Co., Trenton, N. J., Machinery Manufacturers, Donald M. Miller, Sec'y.

Locke Insulator Corp., Maryland Trust Bldg., Baltimore, Md., Porcelain Insulators, F. H. Reagan.

Montgomery Porcelain Products Co., Franklin, Ohio, Mfrs. of Pyrometer Protection Tubes, E. T. Montgomery, Member of Firm and General Manager.

Southern California Gas Co., 950 South Broadway, Los Angeles, Calif., Lee Holtz.

The Robinson Clay Product Co., 1100 Second National Bldg., Akron, Ohio. Manufacturers of Sewer Pipe and Fire Brick, H. B. Manton, Pres.

Membership Workers' Record

	Personal	Corporation
C. E. Bales	2	
A. W. Crownover	1	
R. R. Danielson	1	
Howells Frechette	1	
C. E. Fulton	1	
R. F. Geller	1	
Arthur F. Gorton	1	
R. K. Hursh	1	
A. A. Klein	1	
T. G. McDougal		1
C. R. Minton		1
E. T. Montgomery		1
F. B. Ortman	1	
W. G. Owen	1	
William E. Rice	1	
John Sawyer	4	
Alan Stein	1	
Homer F. Staley		1
Karl Turk	2	
Edward J. Vachuska	2	
Office	7	2
	—	—
Total	29	6

PERSONAL NOTES OF MEMBERS

E. E. Ayars, Chairman of the Refractories Division, is living at 11020 Detroit Ave., Cleveland, Ohio.

Wilbur F. Brown, formerly of New York has been transferred by the Libbey-Owens Glass Company to Nicholas Bldg., Toledo, Ohio.

J. L. Crawford, who has been Research Assistant, Mellon Institute, Pittsburgh, Pa., has accepted a position with the Laclede-Christy Clay Products Co., Railway Exchange Bldg., St. Louis, Mo.

J. C. DeKort is living at 951 Main St., Wheeling, W. Va.

W. E. Dornbach has moved from Baltimore, Md. to 929 Marlyn Road, Philadelphia, Pa.

William H. Lucktenberg has notified the Secretary's office that he has moved from Zanesville, Ohio to 445 S. Ohio Ave., Columbus, Ohio.

George J. Openhym asks that his address be changed from Scarsdale, N. Y. to 80 Walworth Ave., White Plains, N. Y.

F. A. H. Schepers of the Advance Terra Cotta Company has moved from Chicago Heights to Crystal Lake, Ill.

V. S. Schory has moved from 231 Hudson St., Tiffin, Ohio to 914 W. Walnut St., Kokomo, Ind.

Frank C. Schultz, student member has moved to 231 16th Ave., Columbus, Ohio.

Arthur R. Stanbra has notified the Secretary's office that he has moved to 951 Main St., Wheeling, W. Va.

W. J. Sutton, who has been Assistant in the University of Pittsburgh has moved to Foochow, Fukien Province, China., Fukien Christian University.

George A. Williams of Tottenville, Staten Island, N. Y., has accepted a position with Wunderlich Ltd., Sydney, Australia.

Warren S. Williams, formerly of Arnold, Pa., is now living at 815 E. Harvard St., Glendale, Calif.

Wm. A. Yung of the MacBeth-Evans Glass Company has been transferred from Pittsburgh to the Charleroi office of the Company.

NEW LOCAL SECTIONS ORGANIZED

University of Washington Student Local Section

The Board of Trustees of the American Ceramic Society has granted a petition for the formation of a Local Section of the Society to be known as the University of Washington Student Section of the American Ceramic Society. The officers elected are M. E. Reynolds, Chairman and Wallace Thoreson, Secretary. Paul S. MacMichael and Hewitt Wilson were instrumental in the organization of the Section. Monthly meetings will be held throughout the year. Those signing the petition for a Charter were Winthrop C. Brown, Hobert R. Goodrich, Hilding E. Johnson, M. E. Reynolds, Wallace Thoreson, Fred W. Schroeder, Henry C. Fisher, Thomas J. Etherington, Thad. O. Smith, Ralph L. Smith.

Pacific Northwest Section

A second petition has been received by the Board of Trustees of the Society asking that a charter be granted to a new Section, to be known as the Pacific Northwest Section of the American Ceramic Society. The organization was effected at a meeting of the Pacific Northwest Clayworkers' Association held on December 8. The Section was formed to take care of all matters dealing with relations between the American Ceramic Society and the Pacific Northwest Clayworkers' Association.

The officers chosen for the Section are Paul S. MacMichael, President, and Hewitt Wilson, Secretary. S. Geijsbeek was elected Councilor until the January meeting. An invitation has been extended to the members of the Society to visit the Pacific Northwest on the Summer Meeting tour for 1924.

The following members signed the petition asking for the charter: Paul S. Mac Michael, S. Geijsbeek, H. Wilson, F. T. Houlahan, R. A. Swain, M. L. Bryan, Charles P. Oudin, Ernest F. Goodner, W. E. Lemley, A. Lee Bennett, A. H. Wethey, Jr., and L. A. Martin.

Baltimore-Washington Section Petitions

On December 14, 1923, the organization of the Baltimore-Washington Section of the American Ceramic Society was held at the Garden Tea House, Washington, D. C. Thirty-eight were present and the following officers were elected.

B. T. Sweely, Chairman

Karl Turk, Councilor

R. R. Danielson, Vice-chairman

Secretary-Treasurer, Herbert Insley

A motion was passed that the American Ceramic Society be petitioned for permission to form a local section and that dues of $1 a year would be asked to carry on the work of the Section. Members will also be admitted who are not members of the American Ceramic Society.

The meeting was concluded by a short paper by Herbert Insley on the uses of the petrographic microscope in the ceramic industry.

Those attending the meeting were:

Stephen Leech, B. T. Sweely, Joseph P. Rodgers, Karl Turk, Hebert Turk, Richard Turk, Albert Krekel, Edgar A. Worsham, B. W. Ellis, C. B. McComas, C. A. Barrett, Reardon Fusselbaugh, H. B. Little, R. M. Balmert, A. C. Cameron, F. W. Owens, W. B. Taylor, R. R. Danielson, H. D. Foster, Karl Langenbeck, W. L. Prendergast, M. L. Walters, T. D. Hartshorn, A. N. Finn, W. N. Harrison, H. L. Gaardsmoe, V. J.

Roehm, P. H. Bates, D. C. Lindsay, D. E. Parsons, R. F. Geller, E. W. Washburn, Louis Navias, H. G. Wolfram, W. J. Scott, H. Insley.

Fall Meeting of the Pittsburgh Section

H. G. Schurecht

A dinner was served at the University Cafeteria and in spite of the bad weather about forty attended. After the dinner, and before going over to Mellon Institute, R. C. Purdy gave a short informal talk on the growth and development of the Society. Following this the regular meeting was held at the Mellon Institute. The meeting was called to order by Professor A. Silverman.

Professor Silverman proceeded to introduce Frederick Carder of the Steuben Factory, Corning Glass Works, an authority on colored and art glass. Mr. Carder gave an interesting illustrated talk on the development and technique of the glass industry starting with ancient practice and leading up to that of modern times. He concluded his talk by exhibiting some beautiful specimens of modern art glass.

The next speaker introduced by the chairman was Jameson Handy of the Picture Service Corporation of Chicago. His talk was on the value and application of animated and "slow moving pictures" to modern science and how the camera can detect and show things that the eye cannot perceive. He illustrated this by showing a series of three reels of pictures ending with an animated cartoon picture.

A rising vote of thanks was then extended to Mr. Carder and Mr. Handy, and the meeting adjourned.

Those attending:[1]

C. G. Dunkle,—H. J. Heinz Co.
Chas. R. Fettke,—Carnegie Tech.
C. J. Huot,—Pittsburgh Lamp Brass & Glass Co., Swissvale, Pa.
F. C. Flint,—Hazel-Atlas Glass Co.
W. F. Wenning,—Vitro Mfg. Co.
C. R. Peregrine,—% Macbeth Evans Glass Co.
Donald W. Ross,—Findlay Clay Pot Co., Wash., Pa.
Theo. Lenchner,—Vitro Mfg. Co.
John F. Laudig,—H. J. Heinz Co.
K. T. Cheong.
Rudyard Porter.
A. Silverman,—Univ. of Pittsburgh.
H. W. Webber,—Vitro Mfg Co.
Dr. E. W. Tillotson,—Mellon Institute.
T. W. Garve,—Findlay Clay Pot Co., Wash., Pa.
Dr. C. J. Engelder,—Univ. of Pittsburgh.
W. A. Carter,—Burrell Technical Supply Co.
M. L. Bell,—Carnegie Steel Co.
F. Robertson,—Mellon Institute.
C. E. Skinner,—Westinghouse Electric Co., East Pittsburgh.
G. Pole,—Mellon Institute.
K. F. Stahl.
F. F. Rupert,—Mellon Institute.
T. J. Volkommer,—Vitro. Mfg. Co.
R. W. Henry,—Mellon Institute.
L. H. Miller,—Carnegie Institute.

[1] Members are from Pittsburgh unless specified otherwise.

W. C. Fernow,—Aluminum Company of America.
Wm. A. Yung,—Macbeth-Evans Glass Co.
O. P. Brysch,—Koppers Co. Labs., Mellon Institute.
Harold J. Rose,—Koppers Co. Labs., Mellon Institute.
O. O. Malleis,—Koppers Co. Labs., Mellon Institute.
Roy E. Swain.
A. C. Bakken,—Aluminum Company of America.
W. N. Stoneman.
C. S. Taylor,—Research Bureau, Aluminum Company of America.
C. A. Styer,—Westinghouse Electric Co., East Pittsburgh, Pa.
C. M. Bouton,—Bureau of Mines.
H. H. Blau,—Macbeth-Evans Glass Co.
K. K. Stevens,—Carnegie Tech.
D. O. Evans.
S. S. Cole, Koppers Co. Labs., Mellon Institute.
F. Merian.
C. A. Stone,—Macbeth-Evans Glass Co.
C. H. West,—Westmoreland Specialty Co., Grapeville, Pa.
S. B. West, Westmoreland Specialty Co., Grapeville, Pa.
A. E. Blake,—The U. G. I. Contracting Co.
R. C. Purdy,—General Secretary, American Ceramic Society, Columbus, Ohio.
J. E. Hansen,—Mellon Institute.
R. E. Arnold.
T. H. Sant,—John Sant & Sons Co., East Liverpool, Ohio.
C. J. Rodman,—Westinghouse Electric Co, East Pittsburgh, Pa.

1924 ANNUAL CONVENTION

Atlantic City in February is delightful. None of the hotels would consider a convention between February 15 and April 1, because of the regular patrons who during this period crowd Atlantic City. It was necessary to set the convention ahead to the week of February 4 to get it scheduled in Atlantic City. The weather is fine, the salt water bathing is fine, and the board walk and piers are going full tilt all during February.

So much for the season.

The place needs no advertising; it is the greatest resort in America, winter or summer. So much for the place.

Those who attended the last two annual conventions of the American Ceramic Society know that there will be people there to meet, papers to hear, discussions to participate in, and buttonhole lobby chats which none can afford to miss. The general sessions on Monday will be of great interest and value to all. The Division Sessions on Tuesday and Wednesday will pound brass tacks into your problems. Each industrial group will meet separately, with the programs for each confined to their specific and special problems.

The occasion, by record established and by program assured, will be most profitable.

The hosts—can there be a more promising forecast of a well organized, comfortable stay in Atlantic City than to say that the New Jersey Clay Workers Association and Eastern Section of the American Ceramic Society will be the hosts?

This is the set-up for a dignified and profitable convention in America's greatest playground at a popular time of the year for a sea-shore vacation.

SOME OF THE 1923 WORKERS[1]

In the good old days when the entire membership could sit around a table in Section Q with open notebooks and with open frank minds and when each one was known and hailed by his first name, there was a fellowship, a "bond that ties" which counted for loyalty to the group and to each other.

Today there are several such group meetings together and the development and showing of that same fellowship and loyalty which distinguished that single group twenty to twenty-six years ago. There is today more extensive and intensive fellowship among ceramists. This does not need cultivating; it is flourishing because of its realized value to the individuals, to the SOCIETY and to industrial ceramics in general.

It is impossible, however, for any person, even the General Secretary, to know all the members. There is need of making more generally known the faces and the history of the individuals. A complete album, as is had by many organizations, would be very valuable and the SOCIETY will some day be in position to compile and publish one. It is an anticipation of this that the workers will from time to time be shown in the *Journal*.

Robert J. Anderson

R. J. ANDERSON

Born in Cleveland, Ohio, 1892. Attended Case School of Applied Science, 1910–1914, B.S. in metallurgy, 1914. Elected to all honorary, scientific, and scholarship societies in undergraduate school (Theta Tau, Tau Beta Pi, Sigma Xi); post graduate degree Metallurgical Engineer, Case School 1917. Successively instructor in metallurgy, University of Missouri, School of Mines, Rollo, Missouri; metallurgical engineer, American Rolling Mill Co., Middletown, Ohio; research metallurgist with Henry Howe, Columbia University; engineering editor of *The Iron Trade Review*, Cleveland, Ohio; chief metallurgist Cleveland Metal Products Co.; aeronautical engineer, Bureau of Aircraft Production, Detroit; consulting metallurgist; now metallurgical engineer, chief of non-ferrous metals section, U. S. Bureau of Mines, Pittsburgh. Pioneer investigator in U. S. in metallurgy of aluminum. Wide contributor to technical and scientific press on metallurgy. Author, "Metallurgy of Aluminum and Aluminum Alloys," in press 1923–1924. (Henry Carey Baird Co., New York, N. Y.) Became member of this SOCIETY, 1923. Member, A. I. M. M. E. A. S.

[1] The likenesses and personal histories here given do not include all of the 1923 workers. The photo and sketch of several of them have already been given in earlier issues of the *Journal*. Some are not here through inadvertant oversight of the Editors. Others are adverse to having their pictures and sketches given.

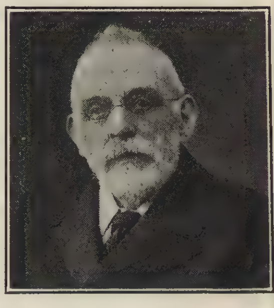
It is not possible at this time to present a complete album of the workers. It is planned to continue collecting photos and personal histories until the SOCIETY shall have its records complete.

T. M.; Institute of Metals (England); Franklin Institute; S. P. E. E.; A. A. A. S.; American Foundrymen's Association; etc. Contribution to *Journal*, 1923, "Metallurgical requirements of refractories."

George H. Ashley


G. H. ASHLEY

Born 1866, Rochester, New York; graduated 1889 with degree of M.E., Cornell University; 1889–1891, with Ward's Natural History Establishment, Rochester; 1891–1894, assistant, Arkansas Geological Survey; 1892–94, post-graduate student Stanford University, degree of A.M. in 1892, Ph.D. in 1894; 1894–1896, teacher of geology, physics, and chemistry in High Schools of Stockton and San Bernardino, California; 1896–1900, assistant state geologist of Indiana and part time acting state geologist, in charge of survey of coal lands of that state; 1900–1903, professor of biology and geology in College of Charleston, S. C.; at the same time assistant of the U. S. Geological Survey; 1903–1910, assistant geologist and, later, geologist of the U. S. Geological Survey and Chief of Section of Eastern Fuels of all geological work in the eastern coal fields, including coöperative work in Pennsylvania; 1910–1912, state geologist of Tennessee; 1912–1919, geologist, U. S. Geological Survey and part time administrative geologist and acting director. Chief of the Section of Eastern Coal Fields. Chief of the Section on Coal of the Land Classification Board; 1919, state geologist of Pennsylvania. Contribution to *Journal*, 1923, "The fire brick materials of Pennsylvania."


J. A. AUDLEY

James Aloysius Audley

Born 1858, Liverpool, England. Raised in the potteries district of North Staffordshire. Attended evening science classes at the Wedgewood Institute Potteries, Mechanics' Institution, and Minton Memorial Building. Studied as a science teacher in training at the Royal College of Science, 1880–1884. Obtained associateship in geology and biology. Elected fellow of Institute of Chemistry of Great Britain and Ireland and a fellow of the Chemical Society of London. Was graduated 1893 with B.S. degree from London University. Served as Science Master at Hanley for sixteen years, two years organizing and teaching science at Shrewsbury Technical School. Became technical chemist at the Eastwood Sanitary Works, Hanley, 1904–1913. Since 1914 connected with and now director of the New Hall Works Pottery Co., Ltd. Contribution to *Journal*, 1923, "The Ceramic Society (English)."


A. E. BADGER

Alfred E. Badger

Born in Cleveland, Ohio, November 25, 1899. Attended Case School of Applied Science 1918–1922.

Associate physicist, glass technology department of National Glass Works in 1922. Joint author with C. D. Spencer of article in *Journal*, 1923, "A skiagraphic study of fabricated glass articles."

Arthur E. Baggs

A. E. BAGGS

Born in Alfred, N. Y., 1886. Ceramic training at New York State School of Ceramics, Alfred, N. Y. 1903–1905 and 1909–1911. Appointed instructor in pottery, Marblehead Handcraft Shops, Marblehead, Mass., 1905. Director of Marblehead Potteries since 1905 and owner since 1915. From 1912–1918 had further study in New York City and served as part time instructor at the Ethical Culture School. Became member of the AMERICAN CERAMIC SOCIETY, 1910. Member Master Craftsman, Boston Society of Arts and Crafts; New York Society of Craftsmen. Chairman, New England Local Section, this SOCIETY, 1923.

Cecil Eugene Bales

C. E. BALES

Born in Livingston, Kentucky. Attended public schools in Louisville. Graduated Du Pont Manual Training High School and Branch School of Engineering. College training secured at University of Chicago and University of Kentucky. Chief chemist, Louisville Fire Brick Works and field assistant of Kentucky Geological Survey. Became member of this SOCIETY in 1921, active member, 1923. Member American Chemical Society, Ceramic Society (English) and Kentucky Academy of Science. Chairman of Program Committee, Refractories Division this SOCIETY, 1923.

Frederick E. Bausch

F. E. BAUSCH

Born in St. Louis, 1871. Graduated from Washington University in 1892 with degree of electrical engineer. Taught three years at St. Louis Manual Training School, 1892–1895. Attended Cornell University, 1895–1896. Electrical engineer with Bell Telephone Co. of Missouri. 1898–1900, mechanical engineer, Missouri Edison Electric Company. 1900–1901, chief engineer, Crystal City, Missouri, plant of Pittsburgh Plate Glass Co. 1901–1923, manager, St. Louis Territory, Hooven, Owens, Rentschler Company of Hamilton, Ohio. Also proprietor of Frederick E. Bausch Fire Clay Mines in St. Louis county and crucible clay mines, Kaolin, Illinois, 1903–1923. Chairman, St. Louis Section, this SOCIETY, 1923 Became member this SOCIETY, 1919; active member, 1923.

Marcus L. Bell

Was graduated from the New York State School of Clay Working and Ceramics at Alfred, New York.

M. L. BELL

Now ceramist with the Carnegie Steel Company, Pittsburgh, Pa. Became member of the AMERICAN CERAMIC SOCIETY in 1909, active member in 1919. Chairman of the Committee on Research, Refractories Division, this SOCIETY, 1923.

A. E. Blake

Born Nashua, New Hampshire, 1887. Was graduated from University of New Hampshire, 1910. Assistant in chemistry, 1910–1911, Rensselaer Polytechnic Institute, Troy, N. Y. Fellow, Mellon Institute, 1911–1914. M.S. degree University of Pittsburgh, 1913. Instructor in chemistry, Carnegie Institute of Technology, 1914–1915. Fellow, Mellon Institute 1915–1917. Findlay Clay Pot Co. Fellowship, Mellon Institute, 1916–1917. Sales engineer, Pittsburgh office, Surface Combustion Company of New York, 1917–1921. Pittsburgh Representative, the U. G. I. Contracting Company, Philadelphia, 1921 to date. Honorary member, Alpha Chi Sigma. Member of the AMERICAN CERAMIC SOCIETY, 1917, active member, 1923, Amer. Chem. Soc., Engineers Soc. of W. Pa. Published several papers on "Surface combustion" and "Water gas." Contribution to *Journal*, 1923, "Cold clean artificial gas" and a discussion upon the "General properties of gaseous fuels."

A. E. BLAKE

James C. Boudreau

Studied art in Boston, New York and Paris. Student in education at Columbia University and the University of Pittsburgh. Student in ceramics at the University of Pittsburgh and Alfred University. Served as aviator during the war. Particular interest in ceramic art education as it functions in the elementary and high schools. Became member of the AMERICAN CERAMIC SOCIETY in 1921, active member, 1923. Is Vice-chairman of the Art Division of this SOCIETY and Chairman of the Committee on Education of the same Division. Contribution to *Journal*, 1923, "Clay as a medium through which educational ideals may be effectively presented."

J. C. BOUDREAU

W. F. Brown

Was graduated Cornell University 1915, specialized in chemistry. Employed at Ball Bros. Glass Co., Muncie, Indiana. Last year of this service as chief chemist, working with R. L. Frink, then chief engineer. Chemical Warfare Service. Bureau of Standards, Optical Glass Section, for short period, leaving for

position as chief chemist, Libbey-Owens Sheet Glass Co., Charleston, W. Va. Served in this capacity four years. Now working in executive offices of that company, at Toledo, Ohio. Became member of the AMERICAN CERAMIC SOCIETY, 1917, active member, 1921. Representative on Committee on Nominations, Glass Division, this SOCIETY, 1923.

W. F. BROWN

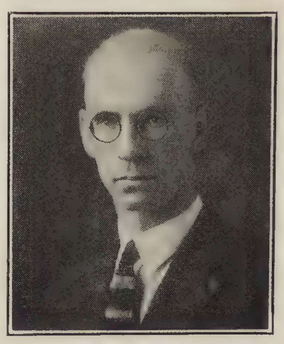
Peter P. Budnikoff

Born, 1885, Smolensk, Russia. Was graduated from the Polytechnical Institute at Riga (Chemical Section) 1911 as engineer technologist. Employed in the manufacturing of electric coals at the station Kudniows near Moscow. From 1912–1914 lectured in chemical technology at the School of Industry and Manufacture at Lodz, Poland. In 1914 was despatched to Augland by the minister of Public Instruction for scientific purposes. From 1914–1916 directed own ceramic works at Smolensk which has existed more than 150 years. In 1916 and 1917 was Administrator of the Manufactory of arms at Moscow. In 1917 voted by the council of professors at Ivanowo-Vosnessensk as docent at the Polytechnical Institute formerly at Riga. Read lectures on mineralogic technology at the Chemie faculty. In 1918 was elected professor in same section. Also read lectures on acid and fire-proof materials on technology of building materials at the Architectural faculty. A member of the scientific council of the Experimental Institute for Silicate at Moscow; German Chemical Society. Since 1918, secretary of the Journal *News of the Polytechnical Institute* at Ivanowo-Vossenensk. Contribution to this *Journal*, 1923, senior author with E. A. Shilov, "The chemistry of the terpene medium for ceramic liquid gold."

P. P. BUDNIKOFF

Bruner Moore Burchfiel

Born in 1898 at Anthony, Kans. Received the degree of A.B. from Southwestern College, Winfield, Kans. in 1918. Was Junior Fellow on the Refractories Manufacturers' Association Fellowship at Mellon Institute in 1918 and 1919. From 1919 to 1921 was a graduate student and assistant instructor in chemistry at the University of California. Received the degree of M.S. in 1920. Since 1921 has been refractories chemist for the Los Angeles Pressed Brick Company, carrying on research work on refractories in the laboratory at their Alberhill, California, plant. Became member AMERICAN CERAMIC SOCIETY in 1921, active member, 1923; member of the American Chemical Society and Sigma Xi. Contribution to this *Journal*, 1923, "Refractory clays of the Alberhill, California deposits."



B. M. BURCHFIEL

Elmer N. Bunting

Born 1892 at Chicago, Ill. Was educated in the Chicago public schools and the University of Chicago (B.S., 1915, and Ph.D., 1918, in chemistry). During the years 1912–1918 was an assistant in chemistry at the University of Chicago, and in 1918–1919 was employed as a ceramic chemist at the Bausch and Lomb Optical Co., of Rochester, N. Y. Since 1920 has been at the University of Illinois as research associate in the Ceramic Engineering Experiment Station. Became member of this SOCIETY, 1922, active member, 1923. Contribution to *Journal*, 1923, "An electric furnace temperature regulator."

E. N. BUNTING

Frederick Carder

Born in England. Started work in father's pottery getting a practical training in all departments. Obtained position as designer in flint glass factory in England. Obtained a gold medal as well as numerous silver ones for designs in glass. Exhibited works in sculpture at the Royal Academy and was awarded a Traveling Scholarship by the Government. Became Master of a School of Art and Technology. Taught glass-making under the County Council of Staffordshire, one of the first classes in this subject in Europe. Made a report for the County Council of Staffordshire of the glass industries of Germany and Austria. Came to America to make a similar report on glass industry of the United States. In 1903, started the Steuben Glass Works with T. G. Hawkes, manufacturing artistic glass. In 1918 this Company was amalgamated with the Corning Glass Works and was made art director of same. Became member of this SOCIETY 1908 active member, 1919. Contribution to *Journal*, 1923, "Artistic glassware." Also Councilor, Art Division, this SOCIETY.

F. CARDER

Charles W. Crane

Born in New Jersey. Began business career in shipping trade with membership at present in the Maratime Exchange of New York. Financially assisted a mine of clay in 1893, saving operator from failure. 1903, incorporated the business under name of Crossman Company, now President and Treasurer of Company, South Amboy, N. J. Trustee of Manufacturers' Association of New Jersey, Vice-president, New Jersey Manufacturers' Casualty Insurance Company and of New Jersey Manufacturers' Association Fire Insurance Company. Became member of this SOCIETY, 1917, active member, 1920. Vice-president, Eastern Section, this SOCIETY, 1923.

C. W. CRANE

J. L. Crawford

J. L. Crawford

Was graduated ceramic engineering, University of Illinois, 1917. Served in Army one year during war. With Westinghouse Lamps Company eighteen months. During past four years has been Industrial Fellow at Mellon Institute, making special study of glasshouse refractories. Became member of this Society in 1916, active member, 1921. Contribution to *Journal*, 1923, "High alumina refractories."

W. J. Darby

W. J. Darby

Born at Florence, Alabama, 1900. Graduated, University of Alabama in 1922, receiving B.S. degree in Chemical Engineering. In August, 1922, was awarded a Research Fellowship at the Missouri School of Mines and Metallurgy, in coöperation with the U. S. Bureau of Mines. Now connected with the Research Division of the New Jersey Zinc Company. Joint author with B. M. O'Harra in *Journal*, 1923, "The disintegration of refractory brick by carbon monoxide."

Frank W. Davis

F. W. Davis

Born Milford, Delaware, 1889. Graduate Lehigh University. Member A. I. M. M. E., Amer. Iron and Steel Institute and Amer. Electro-Chemical Society. Eight years with the Alan Wood Iron and Steel Co. Four months with 110th Infantry, sixteen months with Ordnance Department, U. S. A. Is now metallurgist, U. S. Bureau of Mines, New York City. Contribution to *Journal*, 1923, "Outline of refractories requirements for the iron and steel industry."

Harry E. Davis

Was graduated from Ohio State University, Department of Ceramics, 1919. Was employed with the O. W. Ketchum Terra Cotta Company, Crum Lynn, Pa. With the Northwestern Terra Cotta Company. Chicago, since 1920. November, 1923, took position as head of the terra cotta department of the Tropico Potteries Company, Glendale, Calif. Became member of the American Ceramic Society, 1919, active member, 1923. Secretary and member of Executive Committee of the Chicago Section, this Society, 1923.

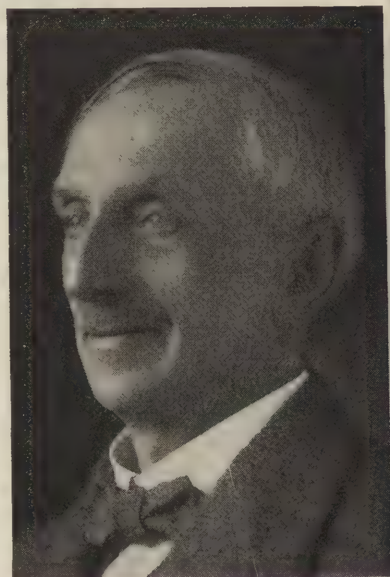
Conrad Dressler

Born Streatham, England. Educated in France and England. Studied at South Kensinger and under Sir Edgar Boehm. Opened studio in Chelsea with small kiln about 1888. In 1893 started the Della Robbia pottery at Birkenhead. Built the Medmenham Pottery, 1896. Made the friezes which surround the Hall of the Law Society, the decoration for the Humphrey Museum,

H. E. DAVIS

Cambridge and the Music Room, Winchester School. Worked on sculpturing 1904–1908. Returned to pottery and developed ideas on tunnel kiln. Built first industrial tunnel kiln, 1911. Dressler Tunnel Ovens Company organized. Built first Dressler tunnel kiln in America in 1915. Settled permanently in America in 1919. Actively engaged in the art of sculpture at studio in Cleveland. Became member of this SOCIETY, 1920, active member, 1921. Contribution to *Journal*, 1923, "The artistic needs of modern faience." Member Committee on Data, Art Division, this SOCIETY.

Warren E. Emley



CONRAD DRESSLER

Received B.S. degree, University of Michigan, 1906, and degree of Ch.E. in 1912. Employed as chemist from 1906–1908, Fletcher Paper Company, Alpena, Michigan. In 1909 connected with the Technologic Branch of the U. S. Geological Survey at Pittsburgh. This work taken over by U. S. Bureau of Standards, 1910. Resigned 1917 to become Assistant to the President of the Riverton Lime Company, Riverton, Va. Returned to Bureau in Washington, 1918. Specialties, lime, gypsum and sand-lime brick. Chairman, Gypsum Committee and Secretary, Brick Committee, A. S. T. M. Honorary member Sand-Lime Brick Association since 1910. Represented U. S. Department of Commerce, Brazilian International Centennial Exposition and the A. S. T. M. at the International Engineering Congress in Rio de Janeiro. Became member of this SOCIETY in 1913, active member, 1915. Senior author of paper with E. B. Berger in *Journal*, 1923, "Panel tests of lime plaster."

G. P. FACKT

G. P. Fackt

Born at Mascoutah, Illinois, 1884. Was graduated from Ohio State University, 1907, with degree of engineer of mines in ceramics. Went to work for the St. Louis Terra Cotta Company as ceramic chemist, remaining there until 1911. Organized the Denver Terra Cotta Company and was vice-president and general manager. This plant was recently purchased

by the Northwestern Terra Cotta Company. Was made president and general manager of the Denver Terra Cotta Company, which retains its identity. Became member of the AMERICAN CERAMIC SOCIETY in 1907, active member, 1919. Councilor for Terra Cotta Division, this SOCIETY, 1923.

R. F. FERGUSON

Robert F. Ferguson

Born at Everett, Pa., 1895. Graduated from the University of Pittsburgh, 1916. Served in the Chemical Warfare Service, Development Division, 1918. Junior Fellow, Refractories Manufacturers' Association Fellowship, Mellon Institute of Industrial Research, University of Pittsburgh, 1919 to date. Secretary, Refractories Division, AMERICAN CERAMIC SOCIETY, 1923. Became a member of this SOCIETY, 1918. Member Committee on Standards. Joint author with R. M. Howe in *Journal*, 1923, "Composition and properties of diaspore bauxite and gibbsite," and with R. M. Howe and S. M. Phelps, "The action of slag upon silica, magnesite, chrome, diaspore and fire clay refractories."

F. C. FLINT

Francis C. Flint

Born in Chicago, Ill., in 1891. Graduated from Pomona College in southern California, 1915. Did graduate work in the University of California. Taught chemistry in college for a while, going into research again during the war. Became member of this SOCIETY, 1919. Has been with the Hazel-Atlas Glass Company since 1920.

Andrew Foltz

President of the Lambertville Pottery Company. Became member of this SOCIETY, 1920, active member, 1921. President of the Eastern Section of this SOCIETY and Chairman of the Executive Committee of the same Section.

A. FOLTZ

Harry D. Foster

Born at Thornville, Ohio, in 1898. Received bachelor's degree in engineering at Ohio State University in 1920, specializing in ceramics. Employed with Mosaic Tile Company in Zanesville during 1919. Since graduation connected with the U. S. Bureau of Standards in coöperation with the Hollow Building Tile Association, on the fire-resistive and other physical properties of hollow building tile. Became member this SOCIETY, 1919, active member, 1923. Member of the A. S. T. M., Committee C-10 on Hollow Building Tile. Contribution to *Journal*, 1923, "Capping for

H. D. Foster

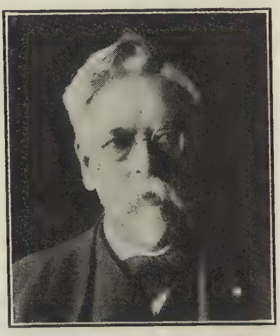
compression specimens," and "Effect of grog addition on the fire resistance of hollow tile."

Frank F. Frederick

Director, The School of Industrial Arts, Trenton, N. J. Contribution to *Journal*, 1923, "School of Industrial Arts," City of Trenton.

Myrtle Merritt French

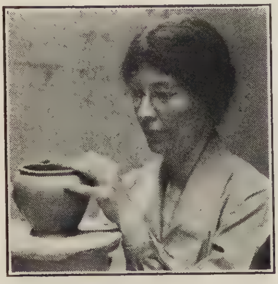
Was graduated from the New York State School of Clay Working and Ceramics at Alfred University, Alfred, N. Y., in 1913, receiving a B.S. degree. 1913–1914 did graduate work at same school; 1914–1915 taught in high school; 1915–1916 taught pottery in Alfred University; 1916–1920 taught pottery and weaving in Carnegie Institute of Technology at Pittsburgh, Pa. From 1921 to present time taught pottery and weaving in Chicago Art Institute. Summers and 1916 studied design at Columbia University, New York; 1917 studied ceramics at Alfred; 1918 to present time taught ceramics at Alfred. 1923 received Frank Logan medal at Chicago Art Institute for pottery. Contribution to *Journal*, 1923, "The problem of the turquoise alkaline glaze."



F. F. Frederick

C. E. Fulton

Was graduated from Rutgers College, 1911, B.S. degree in ceramics. Held ceramic fellowship at the University of Illinois, 1911–1912. Became laboratory assistant in the research department with the Pittsburgh Plate Glass Company in July, 1912. January 1, 1917 to present time, chief engineer with the same Company. Became member of the American Ceramic Society 1911, active member 1915. Member of Committee on Standards (Products) for the Glass Division, this Society, 1923. In recent years a contributor to the *Journal*.



Myrtle M. French

T. W. Garve

Graduate mechanical engineer. Joined the Richardson-Lovejoy Engineering Company in 1907 after previous experience as machinist and designer, continuing with the Lovejoy Engineering Company until 1916. During the latter years took the ceramic course at Ohio State University. Practical experience as burner on continuous and periodic kilns with the Hebron Fire & Pressed Brick Co., Hebron, N. Dak., Waynesfield Tile Works, Waynesfield, Ohio, and the Barbourville Brick Company, Barbourville, Ky. During 1917 was in charge of the shop and business of the Ceramic Supply & Construction Co., Columbus, O., then designer for the Atlas Portland Cement Company, Northampton, Pa., the Findlay Clay Pot Company, Washington, Pa., and the Chain-Belt Company, Milwaukee,

Wis. During 1919, 1920, 1921 and 1922 was construction engineer for the Franklin Brick & Tile Co., Columbus, Ohio, and then for the Clay Products Company of America, New Hope, Pa. During summer, 1922, in charge of burning and kiln remodeling for the Paxtonville plant of the Watsontown Brick Company, Watsontown, Pa. From fall 1922 until fall 1923 construction engineer for the combined plants of the Franklin Brick & Tile Co., Columbus, Ohio, and the Clay Products Company, Brazil, Ind. At present with the Findlay Clay Pot Company, Washington, Pa. Became member of the AMERICAN CERAMIC SOCIETY in 1910, active member in 1913. Contribution to *Journal*, 1923, "Construction features of importance to clay plants."

T. W. GARVE

G. P. Gavin

Received technical training, Lane Technical School, Chicago, Illinois. Assisted in several potteries in Chicago and the East. From New Jersey took position as superintendent of the Kalamazoo Sanitary Manufacturing Company, Kalamazoo, Mich. Contribution to *Journal*, 1923, with F. M. Hartford, "A recent installation of a Harrop tunnel kiln."

C. F. GEIGER

Charles F. Geiger

Graduate, ceramic engineering, University of Illinois. Research assistant in same department one year. Instructor in ceramics, Rutgers College, two years. Located at Camp Dix, New Jersey and U. S. Bureau of Standards, Pittsburgh for investigative work on airplane spark plugs, light aggregate for concrete ships during the war. Employed with the Carborundum Company, Niagara Falls in 1919 for research and application work on silicon carbide and clay refractories. Transferred to refractories division, same Company, Perth Amboy, N. J. in 1920 as refractories engineer in the production and application of silicon carbide and other superior refractories, high temperature cements, fire clay refractories, etc. Became active member this SOCIETY, 1920. Contribution to *Journal*, 1923, "The history of the development of silicon carbide refractories."

R. F. GELLER

R. F. Geller

Born in Fowler, Michigan, 1895. Received B.S. degree in chemical engineering in 1918, University of Michigan. Since leaving the University has been connected with the Bureau of Standards; is now chief of the Refractories Section of the Ceramic Division. Became member, this SOCIETY, 1919, active member, 1921. Is now chairman of the Committee on Stand-

ards. Active member of the A. S. T. M. and is at present a member of Committee C-8 on Refractories and Committee C-10 on Hollow Building Tile. Contributions to *Journal*, 1923, "Progress report on specifications for refractories." Senior author with A. N. Finn, "Further studies on cast glass pots."

Horace W. Gillett

Born Steuben County, N. Y., 1883. Received degrees of A.B., 1906 and Ph.D., 1910, Cornell. Assistant chemist, Cornell, 1906–1907; chemist, A. D. Little, Inc., 1907–1908; assistant in chemistry, Cornell, 1908–1910; manager, research department, Aluminum Castings Company, 1910–1912. From 1912 to present time chief alloy chemist, U. S. Bureau of Mines, New York City. Member, Chemical Society, Electrochemical Society, Mining Engineers and British Institute of Metals. Contribution to *Journal*, 1923, "Metallurgical requirements of refractories for furnaces melting copper alloys."

A. A. GRANGER

Albert Alexander Granger

Born at Paris in 1866. Began career at the Faculté des Sciences of Paris in the laboratory of chemical researches. Was assistant of analytic chemistry 1889–1891. Became professor of ceramic technology and chemistry at the Ceramic School of the Sèvres Manufactory in 1894 at the time of the creation of this school. Received degree of Doctor of Science, 1898. Lecturer for ceramic glass and cement at the École Municipale de Physique et Chimie Industrielles de la Ville de Paris, 1902–1914. Chief of the testing laboratory of the Manufactory at the Sèvres Laboratory, 1909. First researches bore upon inorganic chemistry; at Sèvres spent entire time with questions concerning ceramic and glass industry. Contribution to *Journal*, 1923, "The ceramic industry of France at the end of the 19th century."

Flemmon Porter Hall

Received B.E. degree in 1918 from Vanderbilt University. Was employed at a Government Powder Plant as chemist during 1918. Was employed at Bureau of Standards in the Ceramic Division during 1919–1920. Received S.M. degree from Massachusetts Institute of Technology in 1921. Up until October 1 this year was employed as associate chemist at Bureau of Standards in Ceramic Division. Is now taking graduate work in the department of physical chemistry, Massachusetts Institute of Technology. Became member of this SOCIETY, 1921, active member, 1923. Contribution to *Journal*, 1923, "Effect of hydrogen ion concentration upon clay suspensions."

F. P. HALL

Carl B. Harrop

Engineer of Mines, Ohio State University, 1902; Assistant chemist, Bronson Portland Cement Co., Bronson, Mich., 1902; assistant chemist, National Portland Cement Co., Durham, Ontario, 1903; chief draftsman with W. D. Richardson, brickworks engi-

neer, Columbus, Ohio, 1904; secretary, The Richardson-Lovejoy Engineering Co., Columbus, Ohio, 1905–1910; estimator, The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio, 1907–1910; secretary, treasurer and manager, the Ceramic Supply & Construction Co., Columbus, Ohio, 1910–1913; vice-president, the Richardson-Lovejoy Engineering Co., 1913–1916; part-time instructor of ceramic engineering, Ohio State University, 1910–1913; assistant professor of ceramic engineering, Ohio State University, 1913–1923; in private consulting engineering practice, specializing on continuous tunnel kilns, since 1918. Became member of the AMERICAN CERAMIC SOCIETY, 1914, active member, 1917. Chairman, Committee on Rules, Heavy Clay Products Division, this SOCIETY, 1923.

C. B. HARROP

Theodore D. Hartshorn

Born in Kensington, Md. Graduated from Dartmouth College in 1921 with B.S. degree in Chemistry. In 1918, employed in Chemical Warfare Service, Washington, D. C. In 1920, employed by Hooker Electrochemical Company, Niagara Falls, N. Y. For the past two years connected with the Enameled Metals Section, U. S. Bureau of Standards, Washington, D. C. Joined AMERICAN CERAMIC SOCIETY in 1922, became active member in 1923. Chairman of Committee on Data of the Enamel Division, this SOCIETY for 1923.

T. D. HARTSHORN

Frank M. Hartford

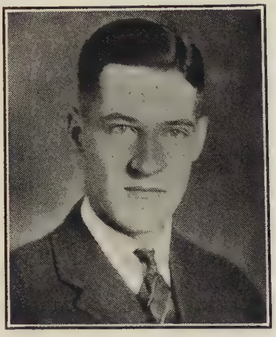
Born, New Philadelphia, Ohio, 1897. Received engineering education, 1916–1918, Ohio State University. Employed with the Chelsea China Company, New Cumberland, W. Va., and since that time associated with Carl B. Harrop, Engineers and Constructors, Columbus, Ohio. Became member of the AMERICAN CERAMIC SOCIETY, 1920, active member, 1923. Joint contributor to *Journal*, 1923 with G. P. Gavin, "A recent installation of a Harrop tunnel kiln."

F. M. HARTFORD

Fred T. Heath

Born, Tacoma, Wash. Entered University of Washington, Seattle, Wash. in 1915 studying architecture. Commissioned in Coast Artillery Corps and transferred to Air Service as observer during the war. Reentered the University of Washington in the newly established ceramics department. Received B.S. degree in 1922, the first degree in ceramic engineering granted at that University. Associated with Prof. Hewitt Wilson during survey of clays and the ceramic industry of the Northwest. Spent one year conducting research stud-

ies in the hollow building tile design with the Heath Unit Tile Company, Tacoma. Received ceramic research fellowship sustained jointly by the Ceramic Station, U. S. Bureau of Mines, of Columbus and the Engineering Experiment Station, Ohio State University, conducting research pertaining to heavy clay products until June, 1924. Became member this SOCIETY, 1919, active member, 1923. Joint author with Hewitt Wilson and A. L. Bennett, *Journal*, 1923, of paper entitled, "Preliminary report on residual kaolin and feldspar in the Pacific Northwest."



F. T. HEATH

Perry D. Helser

Born at Thornville, Ohio, in 1893. Graduated in Ceramic Engineering from the Ohio State University in 1917. One year, Ceramic Engineer with Mosaic Tile Company of Zanesville, Ohio. One year's service as Lieutenant in the Chemical Warfare Service, U. S. A., manufacturing toxic gas at Edgewood Arsenal, Edgewood, Md. Up to the present time connected with the A. C. Spark Plug Company of Flint, Mich., as ceramic engineer. Joined AMERICAN CERAMIC SOCIETY, 1917. Vice-chairman, Detroit Local Section, this SOCIETY, 1923.

P. D. HELSER

Henry W. Hess

Received early training at Toledo High Schools and Scott Manual Training. Graduated from University of Michigan and took post graduate work there. Was first associated with the Toledo Gas Light and Coke Company and for many years with the Libbey Glass Company. For past three years has been consulting chemical engineer in glass, ceramic and fuel industries, Toledo. Became member of the AMERICAN CERAMIC SOCIETY, 1918, active member, 1921. Contribution to *Bulletin*, 1923, "Observations on the European glass industries."

H. W. HESS

L. C. Hewitt

Received degree of B.S. in ceramics, Iowa State College, Ames, Iowa, in 1917. Conducted experimental work for Iowa State Geological Survey during the summer of 1917, followed by work with the Laclede-Christy Clay Products Company at St. Louis, Mo. conducting research work in humidity drying. Since February, 1921, has occupied the position of ceramic engineer for the same company, having charge of the research work connected with the development and application of refractories, specifications for drying clays, composition of mixes and processes of manufacturing. Became member of the AMERICAN CERAMIC SOCIETY in 1919, active member in 1923. Contribution

to *Bulletin*, 1923, "Notes on the burning of refractories with special reference to control of labor costs."

L. C. HEWITT

Charles W. Hill

Born in Clarion, Iowa in 1884. Graduated in chemistry, University of Minnesota, 1905. Received M.A. degree, 1907, and Ph.D. degree in 1910 in inorganic and physical chemistry at the University of Wisconsin. Instructor in chemistry at Wisconsin and associate professor of chemistry at the University of Syracuse. Chemist for St. Paul Gas Company, Laclede Gas Company. Assistant director of Research Laboratories, National Carbon Company. Research chemist in charge of inorganic chemistry, Westinghouse Research Laboratory. One of the founders of the Cleveland Research Laboratory and the Cleveland Electro-Metals Company. Since 1920, General Works Manager for the Atlantic Terra Cotta Company. Has published largely in this *Journal* and other technical publications. Has taken patents on various arc carbons, solders and an indicator and control for furnace atmospheres. Main interest for several years in technical control of factory processes. Active member this SOCIETY since 1920. Chairman of Committee on Standards, Terra Cotta Division.

C. W. HILL

E. C. Hill

Received degree of ceramic engineer from Ohio State University, 1911. Employed in the research department of the Pittsburgh Plate Glass Company from 1911 to 1912. Ceramist with the New York Architectural Terra Cotta Company, Long Island City, N. Y., 1912–1919. Ceramist with the Conkling Armstrong Terra Cotta Company, Philadelphia, Pa. Active member of the AMERICAN CERAMIC SOCIETY since 1912. Chairman of Committee on Data and representative on Committee on Nominations of Terra Cotta Division of SOCIETY, 1923.

E. C. HILL

Roy A. Horning

Born at Hutsonville, Illinois. Was graduated from the University of Illinois, Ceramics Department, 1914. Employed 1914 to 1916 by Armstrong Cork Co., Beaver Falls, Pa., doing research work on heat transmission. Entered service May 1917, commissioned in Engineer Corps, later commissioned first lieutenant in Coast Artillery, went to France with 50th Artillery in 1918. Discharged from the army June, 1919. Returned to the Armstrong Cork Co., Beaver Falls, Pa., and devoted most of the time to efficiency work. Manager of the Lancaster Brick Co., Lancaster, Pa. Became member of the AMERICAN CERAMIC SOCIETY, 1916, active member, 1919. Contribution to *Journal*, 1923, "Experiences with Dutch kilns."

R. A. HORNING

William Otis Hotchkiss

Born Eau Claire, Wis., 1878. Received degrees of B.S., 1903, C.E., 1908, Ph.D., 1916, from the University of Wisconsin. Economic geologist, Wisconsin Geological and Natural History Survey since 1907, director since 1919. State geologist since 1909. Contribution to *Journal*, 1923, "Geology of the Baraboo ganister deposits."

W. O. HOTCHKISS

Herbert Insley

Was graduated from Hamilton College in 1914 and received degree of Ph.D. from the Johns Hopkins University in 1919, specializing in geology. Has been an associate geologist with the U. S. Geological Survey and a petrologist with the U. S. Bureau of Mines. At present he is petrographer for the U. S. Bureau of Standards. Is engaged in research on the constitution of ceramic raw materials and products. Became a member of the AMERICAN CERAMIC SOCIETY, 1922, active member, 1923. Fellow of the Mineralogical Society of America and a member of the Geological Society of Washington. Contribution to *Journal*, 1923, "A study of the origin and cause of stones in glass."

H. INSLEY

R. B. Keplinger

Received A.B. degree, Cornell, 1911. Ceramic work, University of Illinois, 1913 and 1914. With Metropolitan Paving Brick Company from 1911 to present time as time keeper, superintendent, general superintendent and assistant general manager. Became member of the AMERICAN CERAMIC SOCIETY, 1914, active member, 1920. Is Chairman of Heavy Clay Products Division, this SOCIETY, 1923.

R. B. KEPLINGER

R. M. King

Born and reared in Texas. Entered University of Texas in 1912 taking B.A. in chemistry 1916. Chief chemist Alcoa Tennessee Works, Aluminum Company of America for three years. Research Engineer in Electrode Plants, Badin, N. C., and Niagara Falls Works

Aluminum Company of America for two years. Production Superintendent of Carbon Electrode Plant, Alcoa Tennessee Works Aluminum Company of America for one year. Studied ceramics at Ohio State University from Feb., 1922 to June, 1923, taking the degree of Master of Science. Now doing development work for American Lava Corporation, Chattanooga, Tennessee, in coöperation with the U. S. Bureau of Mines Ceramic Station, Columbus, Ohio. Became member of the AMERICAN CERAMIC SOCIETY, 1923. Contribution with A. S. Watts to *Journal*, 1923, "The transfer of heat through refractories and its determination."

R. M. KING

A. A. KLEIN

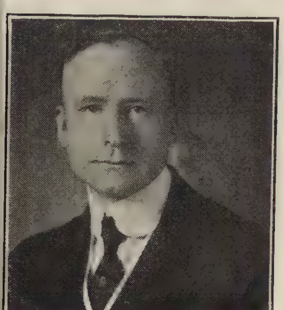
A. A. Klein

Born, Syracuse, N. Y., 1889. Employed with Semet-Solvay Company, 1906–1907. Attended the University of Michigan 1907–11. Assistant in mineralogy, 1908–1911. With Bureau of Standards, 1916. With Norton Company, Worcester, Mass., 1916 to date. Active member of AMERICAN CERAMIC SOCIETY since 1912. Councilor, New England Section, this SOCIETY, 1923. Joint author with M. C. Booze to *Journal*, 1923, "A rapid means for the determination of the quartz content of feldspar."

Herbert Frick Kriege

Born, Omaha, Nebr., 1895. Received B.S. degree Central Wesleyan College, Mo., 1916; A.M. University of Missouri, 1921; post graduate University of Missouri. Taught Iowa High Schools, 1916–1918. Served with Coast Artillery Aug., *1918–Jan., 1919.* Instructor, analytical chemistry, University of Mo., 1921–1923. At present chemist with Missouri State Highway Commission. Contribution to *Journal*, 1923, "Effect of time and temperature on the chlorination of flint fire clay."

H. F. KRIEGE

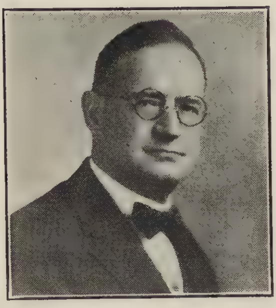


J. B. KRAK

J. B. Krak

Was graduated Fresenius' Laboratory, '07. Received B.S. degree from West Virginia University, 1912. Chemist, West Virginia Geological Survey, 1908–1920. Consulting chemist, United States Window Glass Company, 1914–1920. Technical editor of *The Glass Industry* since 1920. Became member of the AMERICAN CERAMIC SOCIETY, 1921, made active mem-

ber, 1923. Contribution to *Journal*, 1923, "The glass industry."



J. D. LALOR

James D. Lalor

Born in Philadelphia in 1870. Received engineering education under private tutor. Occupied for twenty years with construction work around Philadelphia. Chief engineer and built the Philippine Exposition at Louisiana Purchase Exposition, 1903–1904. In 1909, developed the Lalor Automatic Shut-off and Drain Valves for the protection o fuel oil systems, with factory established in Baltimore, 1913. In 1920, placed Lalor Fuel Oil System on the market. Contribution to *Journal*, 1923, "How to install and operate a fuel oil system."

C. H LAWSON

Carl H. Lawson

Born, Fall River, Mass., 1893. Entered the employ of the Norton Company, Worcester, Mass., in 1908. Served apprenticeship five years in the plant. In 1913 entered the research laboratory of the same company under Ross C. Purdy (then research director). Eight years on factory research work. Superintendent of the Waltham Grinding Wheel Company since 1921. Became member of the AMERICAN CERAMIC SOCIETY, 1917; active member, 1923. Secretary-Treasurer of the Northeastern Section this SOCIETY, 1923.

T. LENCHNER

Theodore Lenchner

Born, New York City, in 1888. Graduated Pennsylvania State College with degree of B.S. in 1912. From 1912 to 1914 with the American Vanadium Company. From 1914–1920, superintendent with the O. Hommel Company, Pittsburgh, Pa., consulting chemist, 1920–1922. Accepted position with the Vitro Manufacturing Company in summer of 1922. Became member of the AMERICAN CERAMIC SOCIETY, 1923. Contribution to *Journal*, 1923, "Glass decorators' palette and its decoration."

P. C. LEONARD

Phil C. Leonard

Born, Joliet, Ill., 1892. Was graduated, 1916, from Lombard College, B.S.degree. Served three years as by-product foreman Dover By-Product Coke Co.,

Dover, Ohio; two years silica work at Joliet for American Coke & Chemical Co., and about three and one-half years with American Refractories Co. Sales work, in charge Chicago office last year before consolidating with present General Refractories Company. At present a salesman with this Company. Became member of the AMERICAN CERAMIC SOCIETY, 1923. Representative on Committee on Nominations, Refractories Division, this SOCIETY, 1923.

J. T. LITTLETON, JR.

Jesse Talbot Littleton, Jr.

Born, Belle Haven, Va., 1887. Received A.B. degree Southern University (Alabama), 1906; fellow, Tulane, 1906–1908, A.M. degree, 1908; Ph.D. degree, University of Wisconsin, 1911. Instructor, University of Michigan, 1911–1913. Since 1913, chief, physical laboratory, Corning Glass Works, Corning, N. Y. Research work centered upon optical constants of metals, alloys and steels, and the mechanical and physical properties of glass. Member, A. A. A. S. and the Physical Society. Contribution to *Journal*, 1923, "The relative magnitude of radiation and convection heating in a muffle kiln."

A. MALINOVSKY

A. Malinovsky

Born at Vienna, Austria, in 1875. Worked in father's plant where stove tile, floor tile and enameled ware was manufactured. Finished the State Real and Gymnasium School at Lauban, Germany. Received instructions in ceramics, and has been employed in different countries in Europe in manufacturing refractory porcelain and enameled sanitary and kitchen utensils. In America has been employed by Randolph and Co., Chicago, Ill. as chemist, developing processes and soils, with the Malinite Co., Belleville Ill., Blackmer and Post, St. Louis, Mo., U. S. Smelting Furnace Co., Belleville, Ill. At present is employed at the Washington Iron Works, Los Angeles, Calif. Has designed and remodeled enameling plants and has done consulting work. Became member of the AMERICAN CERAMIC SOCIETY in 1915; active member, 1923. Is a member of the American Institute of Chemical Engineers, Advance of Science, Illinois State Academy, American and British Ceramic Society, Chairman of the new California section of this SOCIETY. Contribution to *Journal*, 1923, "Method of cooling enamel by compressed air."

M. E. MANSON

Mahlon E. Manson

Born, Terre Haute, Ind., 1895. Graduated from Rose Polytechnic Institute, 1916, as chemical engineer.

Worked as a chemist after graduation for Armour & Co. and Butte & Superior Mining Co. before entering the army. Served overseas with 90th Division. After discharge, worked in Sears-Roebuck laboratory until coming to the Rundle Manufacturing Co. in 1920 as chief chemist. Active member of this SOCIETY since 1921. Contribution to *Journal*, 1923, "The use of bentonite for suspending enamels."

J. D. MARTIN

John D. Martin

Born 1880, Cleveland, Ohio. Was graduated from Ohio State University, 1901, degree Mechanical Engineer. With Pennsylvania Railroad 1901–1904 as special apprentice, motive power department during part of which time acted as member of locomotive testing department at St. Louis Exposition. In June, 1905, took charge of plant of Straitsville Impervious Brick Company, of Thomas Moulding Brick Company, New Straitsville, Ohio. In 1915 also took charge of plant of Buckeye Fire Brick and Clay Company under same ownership, located at Scioto Furnace, Ohio. Is voter in the SOCIETY for the Straitsville Impervious Brick Company, corporation member. Contribution to *Journal*, 1923, "Automatic kiln stokers."

George E. Middleton

Born January, 1890, in Washington, D. C. Received degree of Ceramic Engineer from Ohio State University, 1912. Chemist, Northern Clay Co., Auburn, Washington, 1912–1913. Assistant examiner U. S. Patent Office, 1913–1919. Attended George Washington University, 1913–1916, receiving degree of B.A. Attended George Washington University Law School, 1916–1919. Assistant in patent department of Norton Company, Worcester, Mass., 1919–1920. Associated with the patent law firm of Pennie, Davis, Marvin & Edmonds, 165 Broadway, New York City, from 1920 to the present time. Became member of the AMERICAN CERAMIC SOCIETY, 1914; active member, 1923. Contribution to *Bulletin*, 1923, "Inventions and patents —some phases of the patent law."

Robert J. Montgomery

Was graduated from Ohio State University in 1911 with the degree of Ceramic Engineer. Until 1915 studied and manufactured glass house refractories in the research laboratory of the Pittsburgh Plate Glass Company. In charge of the refractories and high temperature division of the H. Koppers Company's laboratory at the Mellon Institute, Pittsburgh, 1916–1917, working on the standardization of coke oven refractories. Took the position of ceramic engineer with the Bausch and Lomb Optical Co., Rochester, N. Y., in 1917. Assisted in the development and manufacture of optical glass during that period of the war when it was so badly needed by the Army and Navy. Now in charge of the technical work connected with the manufacture of optical glass, ophthalmic or spectacle glass, both clear and colored, and the manufacture of glass pots of special composition required for this type of work. Became member of the AMERICAN CERAMIC

R. J. MONTGOMERY

SOCIETY, 1912; made active member of this SOCIETY in 1916. Contribution to *Journal*, 1923, "Opthalmic glass, a new American product."

Donald A. Moulton

D. A. MOULTON

Born, Ironton, Ohio. Was graduated from Ohio State University in 1908. Became superintendent Condit Forks Brick Company, Condit Falls, Canada until 1913. With the McLain Fire Brick Company, Wellsville, Ohio, in 1920. Since that time professor in the department of ceramic engineering, Iowa State College, Ames, Iowa. Became member of the AMERICAN CERAMIC SOCIETY in 1908, now active member. Joint author with Paul E. Cox of paper in *Journal*, 1923, "A new raw material for ceramic uses."

Alexander Ector Orr Munsell

A. E. O. MUNSELL

Born in Brookline, Mass., 1895. Was graduated from Harvard, 1918. Served in France nine months. Went into the Munsell Color Company which is concerned in the manufacture of Munsell color standards and supplies. Now director of the Munsell Research Laboratory, established in 1923 in memory of Albert H. Munsell, his father, the originator of the Munsell Color System. The laboratory has been located in Baltimore so that it may gain the valuable coöperation of Johns Hopkins University in Baltimore and the Bureau of Standards in Washington. Contribution to *Journal*, 1923, "Simple method of measuring color."

Louis Navias

L. NAVIAS

Born in Grodno, Russia, 1897. Received education, through high school, in Johannesburg, South Africa, matriculating from King Edward VII School in 1913. In the summer of 1914, attended the Columbia University. Transferred to the College of the City of New York, graduating in 1918 with the B.S. degree in chemistry. For two years, 1918–1920, was employed in the glass plant of the Bausch and Lomb Optical Company, Rochester, New York, doing analytical and research work in connection with optical glass. In 1920, came to the University of Illinois for graduate work. Was a Fellow for the two years, 1920–1922. He received the M.S. degree in ceramic chemistry in 1921. Made active member of Sigma Xi in 1921. Became member of this SOCIETY, 1919, active member, 1923. Contribution to *Journal*, 1923, "Measurement of heat absorbed and evolved by clays during firing and burning."

F. P. Nickerson

F. P. Nickerson

Born and reared in Nebraska. After completing early engineering training, entered employ to Deckman-Duty Paving Brick Company, Cleveland, Ohio. Later became field engineer with the Bonnot Company until outbreak of war. Took position of designing engineer for the General Refractories Company. Since 1920 has been employed with the W. S. Tyler Company. Became member of the American Ceramic Society, 1922. Contribution to *Journal*, 1923, "The value of screen analysis in ceramics."

B. M. O'Harra

B. M. O'Harra

Born 1894. Graduated from the South Dakota School of Mines 1915; chemist, American Smelting and Refining Company, Omaha, Nebr., 1915–1917; Research Metallurgist, American Smelting and Refining Company, Omaha, Nebr., 1917–1919; superintendent of electrolytic lead refinery and bismuth plant, American Smelting & Refining Company, Omaha, Nebr., 1919–1921; associate metallurgist, U. S. Bureau of Mines, Mississippi Valley Experiment Station, Rolla, Mo., 1921. Member A. I. M. M. E., and Am. Electrochem. Society. Contributions to *Journal*, 1923, "Metallurgical requirements for refractories in the electrothermic metallurgy of zinc," and senior author with W. J. Darby, "The disintegration of refractory brick by carbon monoxide."

Francis T. Owens

F. T. Owens

Connected with Fiske and Company, Inc., for past thirteen years. Twelve years in production end of the business. Now vice-president. Joined the American Ceramic Society, 1917; became active member, 1919. Contribution to *Bulletin*, 1923, "Importance of figuring taxes into costs."

A. R. Payne

A. R. Payne

Born in Illinois in 1891. Was graduated High School Redlands, Calif., 1909. Graduated Pomona College, Claremont, Calif., 1913, B.S. degree. Attended University of California 1913–1916 as graduate student in physics. Received M.S. degree in 1914. Taught

San Diego Night High School and Coronado High School, 1916–1917. Assistant physicist, U. S. Bureau of Standards, 1917–1919, Washington and Pittsburgh Laboratories. During war in charge of inspection of optical glass for Bureau. Chief Physicist, Hazel-Atlas Glass Company, Clarksburg, W. Va., 1919 to date. Joined the AMERICAN CERAMIC SOCIETY in 1920; became active member, 1921. Chairman, Glass Division, AMERICAN CERAMIC SOCIETY, 1923.

A. B. PECK

Albert B. Peck

Born at Syracuse, N. Y., 1892. A.B. Syracuse University, 1914., A.M. University of Michigan, 1915. Assistant in mineralogy, University of Michigan, 1914–1916. Instructor in mineralogy, University of Michigan, 1916–1917. Assistant and associate physicist, U. S. Bureau of Standards, 1917–1920, in charge of petrographic microscopic investigations of ceramic materials, assistant professor of mineralogy, University of Michigan 1920 to present time. Became member of the AMERICAN CERAMIC SOCIETY in 1920, active member, 1921. Member Sigma Xi, Alpha Chi Sigma (chemical), Fellow, Mineralogical Society, President, Detroit Section, this SOCIETY, 1923.

G. ST. J. PERROTT

G. St. John Perrott

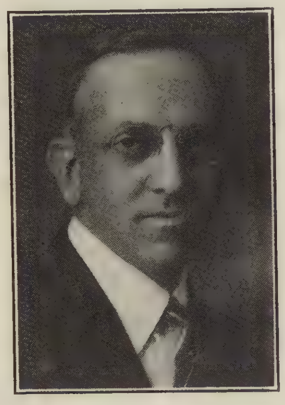
B.A., 1914, and M.A., 1915, North Dakota, physics and chemistry. Two years graduate work in physical chemistry at Princeton University. 1917–1919, Chemical Warfare Service on war gas work (1st Lieut. 1918–1919). Feb.–Oct., 1919, Bureau of Mines surveying carbon black industry. 1919–1920, at Salt Lake City with Smoke Abatement Investigation. 1920–1921, Trent Process Corporation on coöperative work with Bureau of Mines, Pittsburgh. 1921–1923, coke investigation at Bureau of Mines, Tuscaloosa, Ala., 1923. Investigation of Liquid Oxygen Explosives, Bureau of Mines, Pittsburgh. Senior author with S. P. Kinney, *Journal*, 1923, "The meaning and microscopic measurement of average particle size."

A. P. POTTS

Amos P. Potts

Was graduated as ceramic engineer from Ohio State University, 1912. Assistant professor, ceramic engineering, Iowa State College, Ames, Ia., 1912–1913, and associate professor, 1913–1914. Ceramic engineer, Mason City Brick and Tile Company, Mason City, Ia., 1914–1920. Local manager, Seguin Brick and Tile Company, McQueeny, Texas, 1920–1922. Ceramic engineer, The Clay Products Company, Brazil, Indiana, 1922 to date; loaned to the Franklin Brick and

Tile Company as acting superintendent, September, 1922 to June, 1923. Became member this SOCIETY, 1911; active member, 1914. Secretary and Chairman of the Committee on Papers and Programs, Heavy Clay Products Division, this SOCIETY, 1923.



F. R. PYNE

Francis R. Pyne

Graduated from Lehigh University in 1906 with degree of metallurgical engineer. With Boston and Montana Copper Co., Great Falls, Mont., 1906–1909. With United States Metals Refining Co., Carteret, N. J., 1909–1923. With Nichols Copper Co., Laurel Hill, N. Y., at the present time as assistant general superintendent. Made various contributions to the technical press and engineering society transactions on metallurgical subjects. Author of the articles on roasting and copper smelting in Liddell's "Handbook of Chemical Engineering." Contribution to *Journal*, 1923, "Metallurgical requirements of refractories in copper smelting and refining."

Joseph P. Rodgers

Has been actively engaged in the preparation of feldspar for the ceramic industry for the past thirty years. Experience obtained with the Brandywine Summit Kaolin & Feldspar Co., who were favorably known in the business for a great many years. For the past four years has been interested in the Product Sales Co., and he is also treasurer of the Clinchfield Sand & Feldspar Co. Chairman, of Committee on Standards (Tests) in White Wares Division, this SOCIETY, 1923. Became member of the AMERICAN CERAMIC SOCIETY, 1922.

J. P. RODGERS

Charles I. Rose

Born in St. Louis, Mo. in 1901. Received an M.S. degree in Ceramics, and a B.S. in Chemical Engineering at the University of Illinois. Since graduation has been employed in research work on abrasives. Became a member of the AMERICAN CERAMIC SOCIETY, 1922, also American Chemical Society. Contribution to *Journal*, 1923, "Proposed method for studying the attack of molten slags and glasses upon refractory materials."

A. D. SABORSKY

Arthur D. Saborsky

Born in Vienna. Spent the earlier business years in Europe. After graduating from the Engineering College in Berlin, worked for Austrian, German, Italian and English firms, finally settling permanently in the United States. Adopted the engineering of special purpose machinery as particular line, and has

been consulting engineer this branch ever since, located in Cleveland, Ohio. During the depression period of 1921 went to Europe on an "engineering sightseeing" trip. Examined practically all of Europe for new features of engineering, which have developed during the past years of turmoil and readjustment, but due to unbalanced conditions had not reached America. In this connection, found and investigated the progress which manufacture and use of glass wool has taken in Europe. Contribution to *Journal*, 1923, "Glass wool heat insulation in Europe."

H. A. Schwartz

Native of Oldham Co., Kentucky. Was graduated Rose Polytechnic, 1901, M.S. degree, 1903., M.E. degree, 1905. National Malleable Castings Co. at Indianapolis in 1902. Was placed in charge of the entire corporation's malleable metallurgical practice. Since 1920 Manager of Research for the same Company at its Cleveland headquarters. Author of "American Malleable Cast Iron," Member of Amer. Soc. Mech. Engineers, Amer. Chem. Soc., A. I. M. M. E., Society of Automotive Engineers, British Iron and Steel Institute, Amer. Foundrymen's Assoc. Senior author with A. F. Gorton, *Journal*, 1923. "The requirements of fire brick suited to malleable practice."

Carl Schwier

Born in Mansfield Ohio, 1898. Attended college at Western Reserve University and Case School of Applied Science at Cleveland and graduated with a degree of A.B. from the former institution and a B.S. in chemical engineering from the latter in June, 1921. In 1918, spent some months at Camp Zachary Taylor and was commissioned Second Lieutenant in Field Artillery. Entered the employ of the Mansfield Vitreous Enameling Co. in 1921 and for four months worked in all departments of the plant doing all operations in the wet enameling of sheet steel and cast iron. Since that time has remained with the same firm in the capacities of chemical engineer and superintendent and is the present plant superintendent. Joined the American Ceramic Society, 1921. Became active member, 1923. Contribution to *Journal*, 1923, "An electric furnace for vitreous enameling."

C. Schwier

Mary G. Sheerer

Mary G. Sheerer

Born in Kentucky. Studied drawing and painting, Cincinnati Art Academy. Received scholarship to Frank Duveneck's class in oil painting from life and other teachers. Teacher and assistant director, Newcomb Pottery, New Orleans. Became member of the American Ceramic Society, 1922. Member Arts and Craft Association. Contribution to *Bulletin*, 1923, "Exhibition of industrially made table ware." Also Councilor Art Division of this Society.

Mark Sheppard

M. SHEPPARD

Received B.S. in Ceramic Engineering, Alfred University, 1919. Industrial Fellow, Mellon Institute of Industrial Research, 1919–1921. Ceramic Engineer, E. J. Lavino and Company, 1921–1923. Joined the AMERICAN CERAMIC SOCIETY in 1920; became active member, 1923. Contribution to *Journal*, 1923, "Zirconia Refractories."

H. H. Sortwell

H. H. SORTWELL

Born at Lawrenceburg, Ind. Was graduated from University of Illinois in ceramic engineering in 1918. Entered Navy, commissioned for engineering duty, and served overseas. Spent one year with the U. S. Encaustic Tile Works, Indianapolis. Three years at the Bureau of Standards, working on whiteware materials and problems. At present time, ceramic engineer for the Star Porcelain Company, the Frenchtown Porcelain Company, and the Washington Porcelain Company, with headquarters at the Star Porcelain Company, Trenton, N. J. Joined the AMERICAN CERAMIC SOCIETY, 1917; active member, 1921. Contributions to *Journal*, 1923, "The effect of variation in firing on the physical properties of vitreous china bodies" and "Impact tests on tableware."

Charles D. Spencer

C. D. SPENCER

Born in Jacksonville, Florida. Attended the University of Chicago. At present associate physicist, Glass Technology Department, National Lamp Works of General Electric Co., Cleveland, Ohio. Senior author with A. E. Badger, *Journal*, 1913, "A skiagraphic study of fabricated glass articles."

Ira E. Sproat

I. E. SPROAT

Was graduated Ohio State University, ceramic engineering, 1911. Ceramic engineer, three years, Dayton Grinding Wheel Company, Dayton, Ohio. Assistant Ceramic Engineer, U. S. Bureau of Mines, Washington, D. C. one year. Two years with Georgia Kaolin Company, Macon, Ga. Consulting ceramic engineer, Sebring China Company and Limoges China Company, Sebring, Ohio. Past year, manager, pottery department, R. T. Vanderbilt Company, New

York City. Joined the AMERICAN CERAMIC SOCIETY, 1912; became active member, 1920. Member American Chemical Society and A. S. T. M. Chairman of Committee on Membership, White Wares Division, this SOCIETY, 1923. Contribution to *Journal*, 1923, "Effect of heat treatment and composition of semi-porcelain bodies on crazing."

Douglas F. Stevens

D. F. STEVENS

Born in Minneapolis, Minnesota, 1893. Attended Northwestern University and Cornell University, Ithaca, N. Y. Received degree of M. E. from Cornell, 1907. Entered employment of the Acme Brick Company after graduation and has been vice-president and general manager of the Company since 1922. Became member of the AMERICAN CERAMIC SOCIETY, 1913, active member, 1921. Also member of the Illinois Clay Manufacturers Association, National Brick Manufacturers Assoc and American Face Brick Assoc. Is Chairman of the Committee on Membership, Heavy Clay Products Division, this SOCIETY, 1923.

F. L. Steinhoff

F. L. STEINHOFF

Born in Chicago, 1894. Graduated from department of ceramics, University of Illinois, 1917. Since that time connected with Industrial Publications, Inc., as field man, associate editor, and at present managing editor of *Brick and Clay Record*. Is editor of the new journal started in June, called *Ceramic Industry*. Also collaborator with the Clay Products Cyclopedia. Joined the AMERICAN CERAMIC SOCIETY, 1917; became active member, 1919. With W. D. Gates in 1917, organized Chicago Section of this SOCIETY. Is chairman of Committee on Papers and Programs, this year. Contributions to *Journal*, "The log (twenty-five years) of progress in the brick and tile industry" and "Brick and clay record, its history."

W. J. Stephani

W. J. STEPHANI

Born in Bellville, Ill., 1881. Graduated from St. Louis Manual Training School, 1900, Ohio State University, 1900–1903. Excelsior Terra Cotta Co., 1904–1906. Planned and built O. W. Ketcham Terra Cotta Works, 1906. Associated at this time there. Joined the AMERICAN CERAMIC SOCIETY, 1906; became active member, 1912. Councilor, Terra Cotta Division, this SOCIETY, 1923.

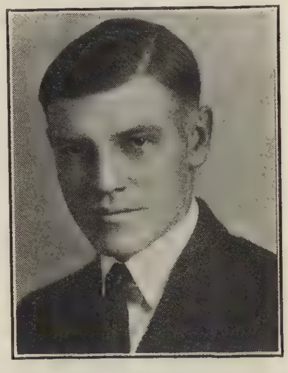
C. O. Swanson

Received A.B. degree Carleton College, Minn., 1899, M.Agr. 1905, College of Agriculture, University

C. O. SWANSON

of Minnesota; Ph.D., 1922, Cornell University. Teacher of science and Agricultural Chemistry. Head of Department of Milling Industry, July, 1923 to present time. State Agricultural College, Manhattan, Kans., Jan. 1918–July 1919, technologist in cereal dust explosion work with the U. S. Dept. of Agriculture, Bureau of Chemistry. Contribution to *Journal*, 1923, "The origin, distribution and meaning of laterite.."

Mark A. Taylor



M. A. TAYLOR

Received degree of B.S. in ceramic engineering at Iowa State College in 1921. One year (1919–20), served as despatcher and chief despatcher, Christy Plant of the Laclede-Christy Company, of St. Louis, Mo. This work was under the direction of Dwight T. Farnham, industrial engineer. Since July, 1921, has been employed by the Vincent Clay Products Company of Fort Dodge, Iowa, as ceramic engineer. At present has charge of the drying, setting, and kiln burning departments. Became member of this SOCIETY, 1922. Contribution to *Journal*, 1923, "Fuel oil as adapted to the chambered continuous kiln."

G. E. THOMAS

George E. Thomas

Educated in mechanical lines, spent several years studying the production and manufacture of glass house refractories under father, a clay working and mining engineer from the Starbridge Clay fields, England. Has been connected for fifteen years with the Highlands Fire Clay Company, St. Louis, Mo., is general manager and superintendent. Member of the AMERICAN CERAMIC SOCIETY, 1911, active member in 1923. Chairman, Membership Committee, St. Louis local section, this SOCIETY.

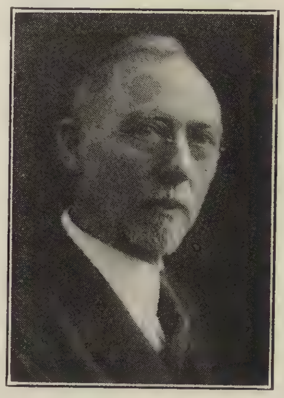
Frederick S. Thompson

F. S. THOMPSON

Degree of Bachelor of Arts from Defiance College and degrees of B.S. and chemical engineer from Case School of Applied Science. Teacher and principal of high school at Le Grand and Colton, Cal., 1913–1917. Assistant manager, Rhode Island Division of the National Lamp Works of the General Electric Co., 1917–1923. Since February of 1923

with glass technology department of same company, Nela Park, Cleveland. Contribution to *Journal*, 1923, "Substituting fuel oil for producer gas in a continuous glass tank."

Charles B. Thwing



C. B. THWING

Was graduated from Northwestern University and the University of Bonn. Was instructor in Physics at Northwestern and Wisconsin and Professor of Physics at Knox College and Syracuse University. Author of two textbooks on physical measurement and of numerous contributions to scientific periodicals. Since 1906 has been engaged in the manufacture of pyrometers and other scientific instruments at Philadelphia. Has invented numerous improvements in pyrometry and has specialized in pyrometers for the ceramic industry. Became member in the SOCIETY, 1917. Contribution to *Journal*, 1923, "Cold end compensation of a pyrometer system."

Karl Turk

KARL TURK

Received initial training in enameling under Theodore Zwerman, Sr., of the Baltimore Enamel and Novelty Company. Worked with the "wet" process for cast iron, particularly stove work. Vice-president, Porcelain Enamel and Manufacturing Company of Baltimore, vice-president, Wolverine Porcelain Enameling Company, Detroit, Mich., and the Scranton Enameling Company, Scranton, Pa., all operating under the "Penn." System. Joined AMERICAN CERAMIC SOCIETY, 1917; became active member, 1921. Chairman, Membership Committee, Enamel Division, this SOCIETY, 1923.

Robert Twells, Jr.

R. TWELLS, JR.

Born in Independence, Ohio, 1895. Worked at sanding molds and in various capacities in plants making sewer pipe, hollow blocks, paving and common brick. In 1914, worked for the Key-James Brick Company, Chattanooga, Tennessee, as foreman of shipping department. Withdrew from the University of Illinois to enter Army service in May, 1917. Was graduated with B.S. degree in ceramic engineering in 1920. Member Tau Beta Pi and Sigma Tau, honorary engineering fraternities, and Keramos, honorary ceramic fraternity. Worked with the General Electric Company, Schenectady, N. Y. Since 1921 employed with the Champion Porcelain Company, now assistant superintendent. Member in SOCIETY since 1920. Chairman, Membership Committee, Detroit Section, this SOCIETY. Contributions to *Journal*, 1923, "Further studies of porcelain glazes, maturing at high temperature" and "Tests on some sagger clays and bodies."

C. A. Underwood

C. A. UNDERWOOD

Was graduated in 1915 from the Worcester Polytechnic Institute. Afterwards served one and one-half years in field of organic chemistry. Associated with Harbison-Walker Refractories Company three years as chemist and representative in the magnesite field in state of Washington. Served in Chemical Warfare Service during war. Later was chief chemist for American Refractories Company three and one-half years. At present connected with sales department of Queen's Run Refractories Co. Became member of the AMERICAN CERAMIC SOCIETY, 1922, active member, 1923. Contribution to *Journal*, 1923, "The analysis of refractories," and to *Bulletin*, 1923, "The analysis of high alumina products."

James G. Vail

Was graduated from Westtown School, Philadelphia, 1904. Became chemist with the Philadelphia Quartz Company; now secretary and chemical director of same company. Took additional work at the University of Pennsylvania, Harvard University and the Institute of Technology in Darmstadt, Germany. Under American Relief Administration directed feeding of under-nourished children in Hamburg, and shipment of supplies into Germany. Member of AMERICAN CERAMIC SOCIETY, 1922; American Institute of Chemical Engineers, Society of Chemical Industry, and the American Chemical Society. Contribution to *Journal*, 1923, "Silicate of soda in the ceramic industry."

J. G. VAIL

A. S. Walden

Has been employed with the National Carbon Company, Inc., Cleveland, Ohio, in the production and engineering departments for twenty-eight years. Became member of the AMERICAN CERAMIC SOCIETY, 1917, active member, 1919. Chairman of the Executive Committee of the Northern Ohio Section, this SOCIETY, 1923.

A. S. WALDEN

Robert A. Weaver

Graduate of Kenyon College. Instructor of English and director of athletics, DoVoe College one year. Assistant sales manager and advertising manager of Eclipse Stove Company for two years, Advertising manager for the Favorite Stove and Range Company for two years. Sales manager for the Porcelain Enamel and Manufacturing Company for two and one-half years. President of the Scranton Enameling Company for one year. Vice-president, Philadelphia

Porcelain Company for two years, and president of the Ferro Enamel Supply Company four years. Joined AMERICAN CERAMIC SOCIETY, 1922. Chairman, Membership Committee, Northern Ohio Section, this SOCIETY, 1923.

R. A. WEAVER

Norman E. Webster

Attended Union College, Schenectady, N. Y. and National Law School, Washington, D. C., receiving degrees of Master of Arts and Master of Laws. Founder and president of the Association of American Government Accountants, and member of the Michigan Association of Certified Public Accountants, of the New York State Society of Certified Public Accountants, of the National Association of Cost Accountants. Now vice-president of the American Institute of Accountants. Five years as chief accountant for the United States Reclamation Service, and since 1909 as a member of Niles & Niles, Certified Public Accountants at 111 Broadway, New York City, and 53 State Street, Boston. Has given especial attention to the cost problems of the ceramic industries. Contribution to *Bulletin*, 1923, "Pricing and costing graded products."

N. E. WEBSTER

Francis C. Welch

Born in Salem, Mass. in 1898. Received B.S. degree, Catholic University, 1920. From 1920–1923 worked as chemist on gypsum at U. S. Bureau of Standards. Now research associate for Gypsum Industries at the Bureau. Contribution to *Journal*, 1923, "Effect of accelerators and retarders on calcined gypsum."

W. F. Wenning

Received education in chemical engineering at Carnegie Institute of Technology and the University of Pittsburgh. Served as Ensign in the United States Navy. At present, head of research and service department, Vitro Manufacturing Company of Pittsburgh. Working on research problems which deal with the manufacture and application of chemicals for ceramic products, specializing in cast and sheet iron enamels. Joined the AMERICAN CERAMIC SOCIETY, 1921; became active member, 1923. Contribution to *Bulletin*, 1923, "Zirconia in sheet iron enamels."

W. F. WENNING

S. Wiester

Came to this country in 1912 for three months to the Enterprise Stamping & Enameling Co., Bellaire, Ohio, to abolish some faults of fabrication on kitchen utensils. Completed this work successfully and was retained by that company until 1914. Equipped the

Baltimore Stamping & Enameling Co. for white kitchenware, which department was closed down in 1916 on account of the war. Took charge of building and equipping the enameling plant of the Malleable Iron Range Company, Beaver Dam, Wis., and supervised it until 1921. In 1922, built and equipped the enameling plant for the Lackawanna Foundry Company, Dickson City, Pa. At present is with the Ironton Stove & Mfg. Co., Ironton, Ohio, to build and equip their new enameling plant, consisting of three Wiester patented fuel oil fired furnaces and to supervise the plant after it is finished. Became member of the AMERICAN CERAMIC SOCIETY, 1920; active member, 1923. Contribution to *Journal*, 1923, "Air-cooled *versus* water-quenched enamels."

S. WIESTER

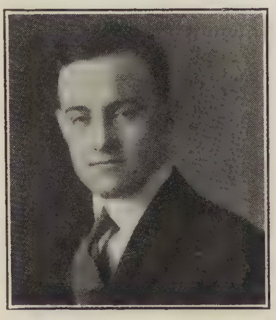
Eugene P. Wightman

Born Baltimore, Md., 1888; B.S. Richmond College, Va., 1908; Ph.D. Johns Hopkins University, Baltimore, Md., 1911; Carnegie research assistant in physical chemistry, Johns Hopkins University, 1911–1914; instructor in chemistry, Washington University, St. Louis, 1914–1915; Fellow, Mellon Institute, Pittsburgh, 1915–1916; acting professor of chemistry, Richmond College, Va., 1916–1917; research chemist, Parke, Davis and Company, Detroit, 1917–1918 and 1919–1920; 1st Lieut., U. S. A. Chemical Warfare Service, 1918–1919; research chemist, Eastman Kodak Co., Rochester, N. Y., since March, 1920. Member American Chemical Society, American Association Advertising Science, Royal Photographers Society of Great Britain, Pictorial Photographers of America. Contribution to *Bulletin*, 1923, discussion on "The meaning and measurement of average particle size."

A. G. WIKOFF

Alan G. Wikoff

Received B. S. degree, College of the City of New York, 1916, majoring in chemistry. M.A. degree, Columbia University, 1917. During 1916 was associated with the Kathol Mfg. Company, then making a substitute for the photographic developer, Metol, using a process involving the electrolytic reduction of organic compounds. During 1917–1918 was chemist for the Waring Mfg. Company, Yonkers, N. Y. From April to December, 1918, with Chemical Warfare Service, assigned to mustard gas plants at Hastings-on-Hudson, N. Y. and Midland, Mich. Joined staff of *Chemical & Metallurgical Engineering*, January, 1919, as Assistant Editor. Became member of this SOCIETY, 1922. Contributions to *Journal*, 1923, "Chemical and metallurgical engineering" and "Refractory requirements for oil refining." A member of the Committee on Membership for the Refractories Division.



C. E. WILLIAMS

Clyde E. Williams

Superintendent and metallurgist, U. S. Bureau of Mines, Northwest Experiment Station, Seattle, Wash. Engaged in research work on electrometallurgy, metallurgy of iron and steel, and refractories. Contribution to *Journal*, 1923, "Requirements of refractories for electric furnaces."

G. A. WILLIAMS

George A. Williams

Born at Peffard, N. Y., 1887. Graduate of Geneseo Normal School, Geneseo, N. Y. Graduate of Alfred University, class of 1913. Professor of ceramics, Rutgers College, New Brunswick for 4 years. Altantic Terra Cotta Co., as chemist, six years. At present with Wunderlich Ltd., Sydney, Australia. Joined AMERICAN CERAMIC SOCIETY, 1921; became active member, 1923. Joint author with W. L. Howat, *Bulletin*, 1923, "Testing barium carbonate for use in terra cotta bodies."

W. S. WILLIAMS

W. S. Williams

Received B.S., University of Illinois, 1909. Practical factory experience in architectural terra cotta, floor and wall tile, optical glass, flint and window glass refractories. Became member of SOCIETY, 1919, active member, 1921. Contribution to *Journal*, 1923, "Effect of various sizes of gray particles on clay pots."

S. S. WYER

Samuel S. Wyer

Born Wayne County, Ohio, 1879. Received M.E. degree, Ohio State University, 1903. Consulting engineer since 1905. Chief of natural gas conservation, Fuel Administration, consulting engineer, U. S. Bureau of Standard, 1918, and U. S. Bureau of Mines, 1920. Member of A. A. A. S., Mechanical Engineers, Mining Engineers, American Gas Institute. Contribution to *Bulletin*, 1923, "Memorandum on power situation in United States in million horse power."

D. C. WYSOR

D. C. Wysor

Born near Dublin, Pulaski County, Virginia. Graduated from Virginia Polytechnic Institute, 1910 with B.S. degree in applied geology. Post graduate studies in geology and engineering, 1910–1911. Civil engineering on location of electrical transmission lines in Virginia and West Virginia. Assistant on Missouri Geological Survey. Mining geologist, General Chemical

Company, 1914 to date. Industrial research in this position carried on in United States, Canada and Cuba. Special work also in Western United States for Nichols Copper Company. Became member of the AMERICAN CERAMIC SOCIETY, 1922. Contribution to *Journal*, 1923, "Diaspore clay of Arkansas and Missouri."

A. S. ZOPFI

A. S. Zopfi

Born 1874 in Sullivan County, N. Y. Educated in country schools, taught school two years. Entered employ of the Findlay Clay Pot Company, Findlay, Ohio, in 1894. In 1909 with W. K. Brownlee organized the Buckeye Clay Pot Company, Toledo, Ohio, holding office of secretary and treasurer, and still continues in such capacity. No technical degree or special training. Became member of the AMERICAN CERAMIC SOCIETY, 1909, active member, 1921. Chairman, Northern Ohio Section, this SOCIETY.

NOTES AND NEWS

CERAMIC DEPARTMENT OF GEORGIA SCHOOL OF TECHNOLOGY

On December 3, 1923, ground was broken for the new ceramics building at Georgia School of Technology. When completed it will house the only Department of Ceramics in the South. For the present, one wing 50 feet wide and 83 feet long, will be built and equipped with a complete clay testing laboratory. Plans, however, contemplate the addition in the future of a two-floor structure, 40 feet wide and 100 feet long. Dark red rough texture brick and terra cotta will be used for construction.

Due to the enthusiastic coöperation of the clay and other industries of Georgia, $40,000 have been subscribed for equipment and maintenance. Among the contributors are the following:

Fulton County Cash	$10,000
Bickerstaff Brick Co. 50,000 brick	500
J. C. Steel and Sons Equipment	2,000
W. G. Massee-Bibb Brick Co. 10 carloads of brick	1,500
S. G. Warner Contractor's services	.....
William Wilson Painter's services	.....
Paint dealer of Atlanta Paint	200
J. B. McGrary & Co. Cash	500
M. C. Kiser Cash	200
B. Mifflin Hood Brick Co. Building material	$1,500
B. Mifflin Hood Equipment	.....
Stevens Pottery Firebrick	.....
Central of Georgia Railway Laboratory equipment	1,500
Atlanta Terra Cotta Co. Cash	1,000
Atlanta Chamber of Commerce Cash	250
Milledgeville Brick Co. 30 carloads of brick	4,500
Edgar Brothers Co. Cash	500
Roper, Strauss, Ferst Co., Inc. 40,000 sq. ft. floor tile	.....

The general assembly of Georgia, largely through the efforts of Senator Carswell, has voted the department an appropriation of $10,000 per year for maintenance beginning January.

Arthur V. Henry of Ohio State University is to be the head of the new Ceramic Department. He received the degree of Ceramic Engineer in 1914, Master of Science in 1921 and will receive the degree of Doctor of Philosophy before taking up his duties on February 1st. He has had six years' experience in the clay industry and served three years during the war as captain of artillery.

A. V. Henry

The establishment of the department is the outcome of a study of the ceramic colleges throughout the country, by Dr. Brittain, president of Georgia Tech. The investigation covered a period of more than one year and included information gathered at numerous meetings of the leaders in the clay industry.

Georgia offers a large field for ceramic research. It has vast beds of kaolins, bauxites, refractory clays, feldspars, fullers' earth and many other minerals, which for the greatest part are still undeveloped. The new ceramic department should be a big asset to the clay industries of the South.

"FUELS AND FURNACES"

Early this year, a new publication entitled *Fuels and Furnaces* in pocket size and published by F. C. Andresen & Associates, Inc., 709 House Building, Pittsburgh, Pa., made its appearance. The caliber of articles included and the Abstract Section, which is a really unusual feature in a magazine of this kind, are of sufficient merit to warrant its careful perusal by all those who are interested in industrial fuels or furnaces in the iron, steel, automotive, glass, ceramic or other industrial processes in which the subjects of fuels and furnaces is of major importance.

The success of this little publication is undoubtedly in large measure due to: the past experience of F. C. Andresen, president of the company; the wide engineering knowledge of W. Trinks, of the Carnegie Institute of Technology; E. H. McClelland, Abstract Editor and head of the Technology Department of the Carnegie Library at Pittsburgh, and of Elmer C. Cook, formerly managing editor of *Forging & Heat Treating* and the *Blast Furnace & Steel Plant*.

Some indication of the scope of this little publication may be gleaned from the titles of articles selected from the first few issues:

"Fuels and Their Handicaps as Related to Drying Ovens."
"Smoke Regulation in Metallurgical Furnaces."
"A New Radiation Pyrometer for the Measurement of High Temperatures."
"Fuel Consumption of Different Types of Furnaces."
"Coke Oven Gas Plant for the Manufacture of Sheet Glass."
"Electric Melting of Non-ferrous Alloys."
"Enameling Furnace Improved."
"Lead Pot Furnace Design."
"High Frequency Induction Furnaces."
"Furnace for Melting Glass."

"Products Yielded by Carbonization of Coal at Low Temperatures."
"Heat Penetration."
"Will Cheap Oxygen Revolutionize Furnace Problems?"
"Capacities of Electric Melting Furnaces."
"A Day at the Ford Plant."
"New Apparatus Successfully Controls Temperatures."
"Operating Gas Tanks."
"The Determination of Melting Points."
"CO_2 and CO Meters Described."
"Heat Balance of a Glass Tank."
"Rules for Designing Resistors."
"Japanning Department."

Fuels and Furnaces is distributed free of charge and those interested need only write the address given above giving their company name and connection to be placed on the regular mailing list.

R. C. PURDY SPEAKS IN TORONTO

Ross C. Purdy, General Secretary of the AMERICAN CERAMIC SOCIETY, delivered an address before the members of the Society of Chemical Industry in Toronto on the evening of Friday, December 14. Mr. Purdy's subject was "The Vitrification of Clays and Allied Problems in the Ceramic Industry."

INTERNATIONAL EXHIBITION OF MODERN DECORATIVE AND INDUSTRIAL ARTS

BY H. H. MORSE

An international exhibition of modern decorative and industrial arts will be held in Paris in the spring of 1925. The United States has been invited to participate by erecting at an expense of approximately $80,000 a temporary building covering about 5600 square feet of ground.

American industry is going to take an active interest and the Department of Commerce should like to know what business firms or individuals would make exhibits and to what extent they would be willing to appropriate funds for that purpose.

It is proposed that the exhibition itself will have the broadest scope and will take in all that can be produced by the artist, manufacturer and mechanic, bringing together all the decorative arts in every form. Five main groups will be represented, which are subdivided as follows:

Group I. Architecture

Class 1. Architecture.—Class 2. Stone-working (artistic and industrial).—Class 3. Wood-working (artistic and industrial).—Class 4. Metal-working (artistic and industrial).—Class 5. Ceramic-ware (artistic and industrial).—Class 6.—Glass-ware (artistic and industrial).

Group II. Furniture

Class 7. Complete suites.—Class 8. Wood and leather furniture.—Class 9. Fancy articles and articles in morocco leather.—Class 10. Artistic and household

metal goods.—Class 11. Ceramic ware.—Class 12. Cut and blown glass.—Class 13. Textile industry.—Class 14. Paper industry.—Class 15. Book industry.—Class 16. Games and toys, sporting goods and apparatus.—Class 17. Scientific instruments.—Class 18. Musical instruments.—Class 19. Means of conveyance.

Group III. Wearing Apparel

Class 20. Clothing.—Class 21. Millinery, gloves and minor articles.—Class 22. Flowers.—Class 23. Jewelry.

Group IV. Theatrical, Street and Garden Architecture and Decoration

Class 24. Scenery and stage properties.—Class 25. Objects for the adornment of streets and boulevards.—Class 26. Landscape gardening.

Group V. Educational

Class 27. Materials for school.—Class 28. Stone.—Class 29. Wood.—Class 30. Metal.—Class 31. China.—Class 32. Glass.—Class 33. Textiles.—Class 34. Paper.—Class 35. Materials of animal or vegetable origin not elsewhere classified.—Class 36. Photography and Cinematography.

NOTES FROM THE BUREAU OF STANDARDS

Tests of Caustic Magnesia Made from Magnesite from Several Sources

The results of a part of the Bureau of Standard's work on oxychloride cement are contained in Technologic Paper No. 239, which may be obtained from the Superintendent of Documents at 10c a copy.

Comparatively few users of this material are really familiar with it. Even among architects and builders, oxychloride cement products are often known only in connection with trade names. The rapidly increasing demand for these materials shows that they possess certain desirable peculiarities, and has made it necessary to replace haphazard or "rule of thumb" methods in the manufacture and use of this cement with more scientific methods based on the study of numerous tests.

Caustic magnesia, the chief constituent of oxychloride cement, was made in the experimental cement plant of the Bureau of Standards by calcining magnesite ore. The temperature and other conditions were varied in order to study the effects on the properties of the product. An ore imported from Greece, one shipped from the State of Washington, and two from different mines in California were used, as these were representative of the chief sources of supply for this country. Cement mixtures, typical of those used by the trade, were then made, and tested both in the laboratory and on panels of flooring and stucco exposed to actual service conditions.

The results of this work form an important contribution to the information necessary for the production of the most satisfactory oxychloride cement products.

Improved Apparatus for Testing Bricks

An improved apparatus for the transverse testing of brick has been designed by H. L. Whittemore of the Bureau of Standards. During the past month 500 brick were tested to determine whether this apparatus was superior to that specified by the American Society for Testing Materials. 250 brick were tested in each apparatus. The

bricks were of 3 different kinds, 200 being clay brick, 200 cement, and 100 sand-lime brick. The average results were practically the same for both types of testing fixtures but with the Whittemore apparatus it was possible to test 100 brick in 3 hours, while $5^1/_4$ hours were required to test the same number with the A. S. T. M. fixtures. With the latter apparatus, 5 pieces are displaced when a brick is broken, and these must be accurately replaced in position for the next test. There are no displaced parts when a brick is broken in the new holder. Since both devices give equal results for the modulus of rupture of a brick, and since the A. S. T. M. fixture requires more time, the new apparatus is evidently an advance in the field of testing equipment.

Development Test for Hardness of Glazes and Investigation to Increase the Hardness of These Glazes

The Ceramic Division of the Bureau of Standards is developing a hardness test for porcelain glazes which consists essentially in wearing away the glaze by means of a standard sand which is allowed to run through an orifice of known dimensions and to strike upon the inclined surface of the specimen after falling a predetermined distance. Satisfactory results are being obtained in comparatively short intervals of time and with small amounts of sand, both being well within practical limitations. A circular letter has been sent to a considerable number of potters asking that samples be submitted for testing.

Meeting of Advisory Board on Dictionary of Specifications

A meeting was held on October 24th of the Board organized to act in an advisory capacity to the Department of Commerce in compiling material for and publishing a handbook of specifications for commodities purchased by federal, state and municipal governments and public institutions. As was mentioned in last month's *Bulletin*, there are more than 20,000 commodities which can properly be classed as articles purchased out of taxes for which there should be specifications, whereas there are now in existence less than 5000 specifications for such commodities.

At the meeting of the Advisory Board, at which there were present representatives from all but one of the organizations represented on the Board, unanimous approval was voted for the proposed plan for issuing shortly in convenient form a thoroughly classified list of all known existing commodity specifications.

The Board voted unanimously for the creation by the Secretary of Commerce, as Chairman of the Board, of three committees from its membership to render reports for the approval of the Board on the subjects of (1) classification of commodity specifications; (2) form and size of the publication; and (3) scope of the proposed handbook or encyclopedia of specifications.

It was the unanimous opinion of the Board that future meetings should be subject to the call of the chair.

CALENDAR OF CONVENTIONS[1]

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 4–9, 1924	Atlantic City
American Concrete Institute	Feb. 25–28, 1924	Chicago

[1] Further information may be secured through the Chamber of Commerce of U. S., Washington, and World's Convention Dates, New York, N. Y.

American Institute of Electrical Engineers	Feb. 4–7, 1924	Philadelphia
American Malleable Castings Assn.	Jan., 1924	Cleveland, Ohio(?)
American Road Builder's Assn.	Jan. 14–18, 1924	Chicago
American Zinc Institute	May, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	April 18, 1924	Washington, D. C.
Common Brick Mfrs. Assn. of America	Feb. 11, 1924	Los Angeles, Calif.
Gas Products Assn.	Jan., 1924	Chicago
Hollow Bldg. Tile Assn.	Jan., 1924	Chicago(?)
Institute of Metals, Div. of American Institute of Mining and Metallurgical Engineers	Feb., 1924	New York City
Natl. Assn. of Stove Mfrs.	May 7–8, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	April 27, 1924	Atlantic City
Natl. Brick Mfrs. Assn.	Jan. 28–Feb. 2, 1924	Cincinnati, Ohio
Natl. Builders Supply Assn., Inc.	Feb., 1924	Chicago(?)
Natl. Electric Light Assn.	May or June, 1924	
Penna. Gas Assn.	April, 1924	Atlantic City
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	April or May, 1924	(?)
Western Society of Engineers	June 4, 1924	Chicago

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Vol. 3 February, 1924 No. 2

EDITORIAL

THE 1924 ANNUAL CONVENTION

The Annual Convention of the American Ceramic Society is an occasion of paper readings but of more importance is it as an occasion for exchanging information on problems of common concern, and for making personal contacts by which coöperation can be had throughout the year in the solving of problems and the obtaining of information. No man has ever with profit lived for and by himself. Mutual dependency on fellow beings has always been and is increasing. We are profiting from things already accomplished and recorded, but the facts being made known today in both fundamental and applied science are so surpassing in amount and in diversity that a year now is as decades past in the revealings of facts essential to economical manufacturing. Collaboration is now far more necessary. The opportunity and time to find the fundamentals, and the capacity to apply them in the devising of ways and means of manufacturing is beyond the possibilities of individuals working alone. These require the collaboration of many. It is in the establishing and maintaining of personal and organized group contacts through which this essential collaboration is possible that conventions have their greatest justification.

The impression is had by some that the larger number of the papers listed on the programs of the convention of this Society are from Univer-

sities, Bureaus and Institutions of research and from those who supply materials and equipment. This is not and has not been the case. For the 1924 Convention 62.4% of the 169 papers and addresses are from the industrial laboratories and factory operators; 8% of these 62% are trade association releases. Only 14.3% of the papers are from Universities and 23.2% from the public and semi-public laboratories.

It is this 62.4% of papers from the industrial workers that reveals the purpose of these annual conventions and the benefits which accrue to the industrialists who attend. It is a logical conclusion that if this holding of conventions for the past 26 years had not profited manufacturers, the number of delegates attending each year would have decreased rather than increased and the percentage of contributions from the factories would not have continued to be in the majority.

If the SOCIETY served in no other wise than as a means of collaborating in the finding and classifying of records of fact findings, and in making application of these to manufacturing it would be worth while. It is and must continue to be more than this. It must be the medium for personal contacts and social relations of men engaged in like pursuits. Our pace in things mechanical is so swift that real effort must be made to keep the human relations apace. We can now "tune in" for a conversation across the ocean. We are today closer to humans on the other side of the world than were the peoples in a given State a few years ago. Canned music or music vibrating direct from strings thousands of miles away are no longer dreams; they are realities for all who will but "tune in." So it is in all human endeavors, industrial as well. We must "tune in," must have the essential equipment and adjustment.

So far there has been no substitute found for the printed record and for the convening together for collaboration as means of securing this essential equipment and adjustment. No one can afford to isolate himself. He must read. He must convene with others.

PAPERS AND DISCUSSIONS

THE PULSICHROMETER

By Francis A. H. Schepers

The discussions on pulsichrome published in this *Journal*[1] were rather brief. The writer has since had occasion to study the advantages of this machine very carefully. Let us first confine ourselves to the laboratory and shipping department of the terra cotta plant. Our first experience was on a rather large job, approximately 1800 tons of terra cotta. A certain amount of samples were run and after the architect's approval was obtained, we immediately set to work. To date we have finished 500 tons of this job and it is gratifying indeed that there was need of reslipping only one piece. The results were 100% perfect as far as the slipping is concerned.

Motor trouble is unknown to us. These machines have run day after day and week after week without the slightest indication of trouble.

Occasionally the men may have to stop for a few minutes to clean their machines, due to some dirt or grit getting in, which, of course, can be entirely overcome by careful screening of the enamels. This "clogging up" can occur with any ordinary slipping machine if the necessary care is not exercised.

Aside from the good results obtained in the slipping room it reduced the cost of manufacture considerably in this department. Where heretofore it required from four to five men to glaze enough terra cotta in two days to fill a fifty-ton kiln, from two to three men can turn out just as much and better work in the same length of time and consequently reduce the cost of labor approximately 50%.

The same saving applies to the glazes, where, with the old method it required about a barrel of glaze to cover from six to eight tons of terra cotta, this same amount is sufficient for about fifteen tons of pulsichrome terra cotta. These are actual usage figures. Quite a few pieces have been examined very thoroughly under the microscope and although the appearance of the glaze is rather thin, the entire surface is well covered.

The work in general is much simpler. We all have tried at some time or other to "imitate" granites with the old method. In most cases it required four men to apply the different colors and what was the result? Generally a loss of time and money and the material produced looked "something like" granite. After careful study and a lot of switching around of the various pieces in the fitting room to secure a fairly good take up in color (thereby depending largely upon the artistic eye of the fitter

[1] E. Clark, "The Use of Pulsichrome from a Manufacturer's Standpoint," *Jour. Amer. Ceram. Soc.*, **5** [11], 826(1922); L. M. Munshaw, "The Pulsichrometer *vs.* An Old Method of Applying Glazes," *ibid.*

boss) we were satisfied it would pass as "granite." This has been a common occurrence in many plants and we all can see the results daily at the buildings.

The laboratory also benefits a great deal with the use of pulsichrome as the amount of colors used is greatly reduced in number. Large batches of enamels and slips are made up and after the correct specific gravity is obtained, all there is required is a little intelligence on the part of the workman who handles the machine.

Another nice feature is the ease with which certain color combinations are reproduced after a certain length of time, especially in a case of "remakes." It is unnecessary to run all over the yard and find an old overpiece of a certain job or perhaps try to find the man who made it years ago and try to duplicate it, trusting to luck that it will look somewhat like the original job. All we need in this case is the correct specific gravity of the colors, plate number and air pressure and the pulsichrometer will do the rest.

Another fact deserves mention. While heretofore quite often objections were raised by the men in the slipping room about the dust "flying" around with the old method of spraying, we have now a machine which eliminates this nuisance entirely.

Finally we come to the artistic value of the pulsichrometer. How tiresome it is to look at those plain white or cream surfaces on the buildings we all know. They may be practical, but the pulsichrometer will combine beauty with this feature.

Some time ago the writer drove by Terra Cotta Avenue in Chicago (sometimes called Midway) and had an opportunity to observe the various color schemes in the buildings. The most wonderful results have been obtained, and many fine examples of pulsichrome are to be seen. Pulsichrome is in its infancy. Beautiful things have been created in the course of a few years and let us ask the question now; what are we going to see in the next ten years? This answer is solely up to the terra cotta manufacturer. We cannot afford to let everybody have his way about it, for if we do pulsichrome will be discarded in a very short time. The success of it lies in the coöperation of the architect with the plant chemist. If the practical chemist, with his broad knowledge of colors and color combinations can foresee freaky results, it is his duty to caution the architect and only put those combinations on the market which are a credit to pulsichrome. The experienced plant chemist holds the future of the pulsichrometer, on his good judgment and artistic feelings depends the production of material of value.

Let us be conservative with the selecting of colors and entrust the machine only to those who are capable of handling it. We can put a box of paint and brushes into the hands of a child, but will this child produce

anything of value? The same with the pulsichrometer. The people will have to be shown what can be produced by the intelligent selection of colors, the experienced man must in his turn instruct the novice to use only such colors that will give perfect harmony and express the beauty of terra cotta.

Pulsichrome is also an important factor in combination with polychrome. We are well aware of the deplorable results that can be seen in polychrome. Pulsichrome eliminates this completely. Once a certain combination of colors is decided upon, each one of these colors can be used separately for decorating certain fields and the result is that pulsichrome combined with polychrome is in harmony, it is bound to produce a pleasing effect, something soothing to the eye without having to wear smoked glasses in order to be able to stand the strain in looking at them.

The pulsichrometer is a source of untold mysteries. Sometimes we are trying to get a certain color effect, and how agreeably are we surprised when our experimental work comes from the kilns, and we say to ourselves that we do not remember putting that certain color combination on the samples. How many times do we produce an effect, that we were not looking for at all, something better and more beautiful than we expected? The old method of glazing did not possess the charm and power to blend the different oxides to produce color schemes hitherto unknown.

We have gone a great step forward in making good our statement, that "terra cotta shall look like terra cotta" and not be an imitation of some other material. Pulsichrome has its unique appearance and wherever it is used on a building will immediately characterize the material as the "nec plus ultra" of terra cotta.

The Advance Terra Cotta Co
Chicago Heights, Ill.

ELIMINATION OF WASTE IN THE HEAVY CLAY PRODUCTS INDUSTRY

By Marion W. Blair

Waste in various forms is characteristic of American methods in general. We were horrified by our own reckless extravagance in waging the late war, but we continue year after year to pay an increasing bill of upward of $25,000 per hour for preventable fire loss. We let $30,000 per hour run to waste at Niagara Falls, and continue to pay an annual board bill for rats amounting to more than $200,000,000.

These figures throw into insignificance the petty waste of coal, oil, time and labor existing in the manufacture of heavy clay products. There is this outstanding difference, however. The fire and rat loss is borne collectively by 110,000,000 people, and it is difficult to place individual

responsibility, but the waste sustained by the manufacturer of heavy clay products is borne by the individual responsible for it, or by his close business associates and financial backers.

The waste begins with the establishment of the plant, purchase of its site and raw material supply. Hundreds of acres of needless shale and clay lands or mineral rights are bought, and future years must carry the burden of sleeping capital and extra taxation.

Land that is barren and worthless suddenly takes on a new value as raw material when acquired by a clay working corporation.

One million brick per foot acre of clay is a conservative figure. There is then a possible 25,000,000 or 50,000 per day for two years in an acre of clay 25 feet deep, with 50 years operation in a 25-acre deposit of clay 25 feet deep. It would seem a needless waste of capital to tie it up in land which probably will not be touched for 200 years. Capital at 6% unemployed eats its head off six times in a century.

Complete monopoly of raw material in any given district is an impossible if not an undesirable condition. The inability to make future purchase at a relatively reasonable figure is an unlikely condition, and has not been borne out by past experience. However, cumbersome and useless property with a fictitious value has been an obstacle to the sale of many plants, and has been an important factor in the failure of clayworking enterprises.

Plants have been built to supply a temporary local demand without any chance of marketing a future output at a profit, and the growing necessity of entering new fields develops the fact that the relation of market and location had been entirely overlooked. The waste due to poor location eats into profits year after year, and no amount of ingenuity can make it up. Building without competent engineering service often prolongs the period of eye tooth cutting characteristic of the first year's operation of most new plants—and a standardized product is much slower to attain.

The majority of the going plants, the exception being a dozen or so recently built and properly engineered, are suffering from these handicaps of bad judgment and misapplied capital.

Other wastes, those of operation, due largely to lack of attention to small details, can be very greatly reduced or eliminated, and therein lies a profit not to be despised in spite of higher fuel and labor and almost prohibitive freight rates.

Those plants which have been established some years are suffering wastes as a matter of habit. Things are done thus for no other reason than that they have been done thus in the past. If a question is raised the answer is that so and so is a practical man and has been doing it that way for twenty-five years. But suppose it can be done better or cheaper or both, does twenty-five years of past error or ignorance justify twenty minutes continuation if it is losing money? No matter how much profit there

may be in a particular operation, money is being lost if it is possible to do it cheaper and better. For instance, long time burning has been shown to be unnecessary on plant after plant. The operation has been guessed at for years by the so-called practical man. Pyrometer systems have been fought by him—in some cases thrown in the discard as useless—and the eight and nine day burn continues, involving a waste of time, labor, fuel and capital. Many burns are carried along eight or nine days because of fear of carbon and consequent swelling, and the burner would prefer, through indifference or ignorance, to shovel coal two days rather than arrange proper trials to be drawn to determine when the carbon has disappeared and it is safe to raise the heat.

It is perhaps typical of the industry that some $20,000 has been spent in the last two years to convince itself that time and fuel can be saved on present equipment by knowing at all times how hot the kiln is, and keeping the fires going so as to advance the heat continuously. Yet more than ten years ago six day burns of shale paving block in periodic kilns were not unknown, but an intelligent application of the discovery to the industry has not yet been made. It was thought better to burn 25% excess fuel and play safe than to risk even one kiln in an effort to save that amount.

I once read a story of a business man who walked over a fairly prosperous farm and threw down in cash the value of machinery which was lying about ruined by exposure to weather and careless abuse. Twenty dollars here for a plow, two hundred for a binder, a dollar for a spading fork, to say nothing of scythes hung in trees and crops left to rot on the ground. I have often thought that a reckless banker could find a good day's amusement on the average brick plant sowing silver in the place of half- or never-used equipment—bolts, railroad spikes, wheelbarrows, clay cars, locomotives, pugmills, cutting tables, brick machines, engines, and boilers lying about—the management either too sentimental or worse to turn same into cash either as second band equipment or scrap.

Covering for steam pipe pays for itself in forty-five days. The job should be complete and include fittings, valves and separators. The plants whose steam lines are not covered are paying for the material eight times a year, and getting nothing for the money.

Engine oil which should go through a thirty-five dollar filter and be reclaimed goes into the ground around the foundation.

Driers are crowded and each attempt to set green ware results in excessive waste, both in bats on the drier cars and number two ware in the kilns. Burned bats are carted to the dump rather than repair a kiln floor. Number 1 brick go out with the No. 2 and No. 2 with the No. 1. Weights are not checked—a die is run as long as it will produce a column. If oversize it wastes material, power, fuel and freight. A small amount per brick runs into hundreds of dollars on a ten million production.

Kilns are allowed to cool according to the weather and seldom on a schedule; the invested capital and production they represent idle and limited.

Repairs are ordered after a breakdown. Not in advance.

One plant in a thousand owns or uses indicators, anemometers, gas analysis outfits or other controlling apparatus. Such operations as could be accurately measured are guessed at, and the result is waste—boiler walls and arches leak, air heat of exhaust steam goes through the roof instead of into feed water.

There are plants where the test for a hot drier is to spit on the fan housing, and kiln fires regulated by kicking a gas valve. Is it any wonder that the past year has seen plant after plant shut down for lack of business at a profitable price, or that there has been almost a square yard of concrete pavement laid for each brick that has been so used?

Criticism without constructive suggestion is worthless, and the natural question after such an arraignment as the foregoing is, "What is the solution?" The answer has not changed a particle in two years, and it will not change in another fifty. It is the employment of trained minds in responsible positions—foremanships and superintendents—men who have been taught to think from cause to effect and back again. The payment of sufficient salaries, and enough of them to hold the technical men in the industry and keep them out of white collars.

St. Louis, Mo.

DISCUSSION ON "SUBSTITUTING OIL FOR PRODUCER GAS"[1]

G. Ross:[2] We are using Mexican fuel oil of 12–13° Baumé, preheated at about 45°C in burners, to heat a furnace of 7 x 1.3 m. section. The depth of this furnace is 2 m. For our purposes the highest regularity and highest division possible of the developed calories is of the biggest importance. To spread the flames and calories regularly on the surface of 7 x 1.3 m. we made many trials with pressure, temperature and gravity of oil.

The temperature we need is about 1450°C. First we began with oil of 16°Bé. But soon we remarked a partial decomposition of the atomized oil, the fumes charged with oil gases brought them to the lower parts of the furnace till to the top of the chimney of 25 m. high.

At the high temperature we need a heavier oil to avoid decomposition, which burns slower and makes it easier to divide the calories throughout the furnace section. The 12°Bé gave us satisfaction. Essaying the pressure for the purpose of spreading the flames as regularly as possible and to arrive at the same time at the highest temperature to be developed

[1] *Bull. Amer. Ceram. Soc.*, **2** [12], 373 (1923).

[2] Metallurgical Engineer. Saltillo, Coah., Mexico.

near the mouth of the burner, we first used 40 pounds. But these pressures gave us the bigger part of the calories $^2/_3$ of the way from burner to the end of the furnace. The combustion of the mixture of oil and air was too late to permit us to arrive at the highest temperature we need. With 10–12 pounds the result was the best for assuring high temperature at about 1 m. distance from the burner and to bring the calories about everywhere in the section.

To bring the calories necessary to the objects placed in the laboratory of the furnace, we are burning with a slight excess of atomized oil. In this way the calories are transmitted the best to the objects to be handled, the carbon particles of the excess fuel oil are necessary for heat transporting and transmission.

The price of Mexican fuel oil we use is about 0.60–0.65 cts. per barrel in the car at Tampico. The ton of oil cif workplant is about 10 dollars. Mexican coal will be about 7 dollars cif. Costs for our purposes are cheaper with oil than with the coal.

ACTIVITIES OF THE SOCIETY

THE ROSTER IS RISING

Thirty-three persons and six corporations joined during the month of December 15 to January 15. A good start is already had for a big record for January. The "saturation point" is not yet in evidence. Who said this could not be a SOCIETY of 3000 persons and 500 corporations? It can and it will as long as each member does his share of coöperating. The net totals to date are 1990 persons and 296 corporations or a grand total of 2286.

The record for the year 1923 by months is as follows:

	Persons	Corporations			
January	110	10	August	17	3
February	29	0	September	15	2
March	37	3	October	68	30
April	37	7	November	29	6
May	32	7	December	31	6
June	20	6			
July	27	5	Total	452	85

The net gains by years have been as follows:

1918	180	33	1921	221	47
1919	231	44	1922	261	77
1920	181	15	1923	379	80
			Total	1453	296

Is there any evidence here of a let-up in the rapid roster rise? Is the SOCIETY nearing the "saturation point?" No.

NEW MEMBERS RECEIVED FROM DECEMBER 15 TO JANUARY 15

PERSONAL

H. Clinton Baldwin, Y. M. C. A., Perth Amboy, N. J., Roessler & Hasslacher Co.

Harold D. Barger, Salesman, Wellsville Fire Brick Co., Wellsville, Mo.

R. F. Benzinger, The Electric Furnace Co., Salem, Ohio, Vice-President and Sales Manager.

H. R. Borland, 206 Barker Ave., Peoria, Ill., Ceramic Engineer, Peoria Brick & Tile Co.

Emil Bronlund, Brule Mines P. O., Alberta, Canada, Superintendent, Blue Diamond Coal Co., Ltd.

William T. Christian, Supt., Wellsville Fire Brick Co., Wellsville, Mo.

Robert L. Clark, 3101 Passyunk Ave., Lab. Asst., U. G. I. Contracting Co., Philadelphia, Pa.

Anthony Di Dio, Glenn Hotel, Richmond, Calif., Chemist, Pacific Sanitary Mfg. Co., Vitreous Plant.

Morgan B. Eilert, Red Bank, N. J., Supt., The C. Pardee Works, Perth Amboy, N. J.

Chas. F. Eilert, Red Bank, N. J., Manager-Secretary, The C. Pardee Works, Perth Amboy, N. J.

Roger L. Fellows, 109 N. Ashland Ave., La Grange, Ill., University of Illinois.

Shinzaburo Fuzita, % Mitsui Dyestuff & Chemical Works, Omuta, Japan, Engineer of the Fire Brick Department.

Robert Galbraith, Crystal Lake, Ill., Lab. Asst., American Terra Cotta & Ceramic Co.

Gustave Glocker, North East Porcelain Co., North East, Md.

E. Carlile Gravatt, 59 N. Pearl St., Bridgeton, N. J., Illinois Glass Co.

Earl B. Hagar, Asst. Supt., Wellsville Fire Brick Co., Wellsville, Mo.

W. D. Harvey, Monarch Engineering Mfg. Co., 1206 American Bldg., Baltimore, Md.

Earl L. Hauman, Hillview Place, Hamburg, N. Y., Engineer, Electro-Refractories Corp., Buffalo, N. Y.

Raymond A. Heindl, 4917 43rd St., N. W., Washington, D. C., Asst. Chemical Engineer, Ceramic Division, U. S. Bureau of Standards.

C. Walter Kelly, Jr., 3756 Hancock Ave., W., Detroit, Mich., Sales Manager, Face & Fire Brick Division, United Fuel & Supply Co.

Edward R. Ketchem, 242 North E St., Hamilton, Ohio, Enameling Plant, Estate Stove Co.

H. G. Kiger, Manager, Wellsville Fire Brick Co., Wellsville, Mo.

William C. Loudon, 2635 Norman Ave., Detroit, Mich., Head Mason Inspector, Detroit City Gas Co.

Leroy Marx, % The Denver Terra Cotta Co., Box 1860, Denver, Colo., Ceramist.

Daniel J. McSwiney, 1819 Maple St., Alton, Ill., Consulting Chemist.

George Z. McClelland, Gladding-McBean & Co., Lincoln, Calif.

Harold V. E. M. Renn, Sowerby's Ellison Glass Works, Glass Technologist, Gateshead-on-Tyne, England.

William Reynolds, Asst. Supt., Scranton Enameling Co., Scranton, Pa.

Murray Sinclair, West Morris St., Bath, N. Y., H. P. Sinclair & Co.

George Sirovy, 1486 Perry St., Des Plaines, Ill., Enameler.

Evelyn Tennyson, Alfred University, Alfred, N. Y. (Student Member).

CORPORATION

Buckwalter Stove Co., Royersford, Pa., Joseph A. Buckwalter, Treasurer.

Cleveland Metal Products Co., Cleveland, Ohio, C. A. Blackburn, Superintendent.

Grand Rapids Refrigerator Co., Grand Rapids, Mich., Charles H. Leonard, President.

Mansfield Vitreous Enameling Co., Mansfield, Ohio, P. A. Adams.

Scranton Enameling Co., New York & Jefferson Aves., Scranton, Pa.

Wolverine Porcelain Enameling Co., 3350 Scotten Ave., Detroit, Mich.

PERSONAL NOTES OF MEMBERS

A. R. Anderson of the Kentucky-American Clay Co., requests that his address be changed to Pineville, Ky.

Robert E. Armstrong, salesman for Harbison-Walker Refractories Co., has moved to 712 E. 50th St., Indianapolis, Ind.

Edwin P. Arthur, formerly of Columbus, Ohio, is at Morgantown, W. Va., 701 Willey St.

Edgar Boblett, formerly of Nappanee, Ind., is located at Culver, Ind.

B. M. Burchfiel has completed his work with the Los Angeles Pressed Brick Co., and is now connected with the Pacific Clay Products Co., Inc., 306 West Avenue 26, Los Angeles, Calif.

H. T. Bush is at Inglebush, Porte Hope, Ontario, Canada.

Rod. Castro Oliveira gives as his permanent address Casilla 4049 Santiago, Chili, S. A.

Max D. Compton is now living at 4254 Moneta Ave., Los Angeles, Calif.

Karl Ford, of the Bureau of Standards, Washington, D. C., has moved from Silver Springs, Md., to 1333 30th St., N. W., Washington, D. C.

Major E. Gates, who has been located at 138 N. LaSalle St., Chicago, Ill., has moved his office to 128 N. Wells St.

Clarence A. Hall, has moved from Cresheim Arms, Allen Lane, Mt. Airy, to 7951 Winston Road, Chestnut Hill, Philadelphia, Pa.

Mitsu Kato, who has been listed among "Unknown Addresses," gives Mitsuishi-cho, Okayamaken, Japan, as his address.

Walter T. Lippert gives as a new address 123 Fayette St., Bridgeton, N. J.

Crawford Madeira has moved from 900 North American Bldg., to the Atlantic Bldg., Philadelphia, Pa.

Jefferson Middleton gives as his address 3401 16th St., N. W., Apt. 23, Washington, D. C.

Frank E. Owen, formerly of Findlay, Ohio, is now with the General Porcelain Co., Parkersburg, W. Va.

F. W. Owens requests that his mail be sent to the National Enameling & Stamping Co., 1901 Light St., Baltimore, Md.

George W. Parker is located at 603 Laclede Gas Bldg., St. Louis, Mo.

R. J. Riley has notified the Secretary's office that he has moved from Brightwood, Ind., to Terra Cotta, Ill.

T. D. Tefft is now located at Darlington, Pa.

Erwin F. Theobald requests that communications be sent to him at 1413 13th St., N. W., Canton, Ohio.

Boris Trifonoff has moved from Muncie, Ind., to 1210 Elm St., Zanesville, Ohio.

Ray T. Watkins is now living at 503 S. Race St., Urbana, Ill.

Robert C. Zehm, formerly with the Bureau of Mines, is now employed with the Los Angeles Pressed Brick Co., Los Angeles, Calif.

MEMBERSHIP WORKERS' RECORD

	Personal
Charles F. Binns	1
B. F. Carter	1
R. R. Danielson	1
Geo. P. Fackt	1
R. F. Geller	1
V. A. Giesey	1
Roland J. Gouin	1
R. K. Hursh	1
I. A. Krusen	4
Paul G. Larkin	1
Walter T. Lippert	1
M. E. Manson	1

	Personal	Corporation
Percival Marson	1	
L. M. Munshaw	1	
Andrew N. Outzen	1	
Carl Perg	1	
W. A. Potter	1	
Hachiro Saito	1	
George Simcoe	1	
Donald E. Sharp	1	
Karl Turk	1	4
Otto W. Will	1	
Office	6	2
	—	—
Total	31	6

ADDRESSES UNKNOWN

Members of the AMERICAN CERAMIC SOCIETY are urgently requested to forward the correct addresses of the following persons whose *Journals* have been returned to the office of the Secretary as a result of an insufficient or incorrect address. The address given below with the name is the last one which appeared on the official file of the SOCIETY.

Fred J. A. Arbenz, Florentine Pottery Co., Cambridge, Ohio.
G. L. Austin, Joliet, Ill.
G. V. Baker, Penn Feldspar Co., Barnard, N. Y.
Earl A. Bickel, Postville Clay Products Co., Postville, Iowa.
Fred H. Butterfield, 4906 McPherson Ave., St. Louis, Mo., Crunden Martin Mfg. Co.
A. Marietta Byrnes, 63 Anderson Place, New Orleans, La.
J. P. Callaghan, % Teaque Hotel, Montgomery, Ala.
C. V. Cameron, Whiting-Mead Commercial Co., 2035 E. Vernon Ave., Los Angeles, Calif.
Homer T. Darlington, Box 736, Natrona, Pa.
S. E. Davis, 1117 Murdock Ave., Parkersburg, W. Va.
Charles S. Dolley, Keramoid Mfg. Co., Fort Madison, Iowa.
L. E. Ells, 4255a Flad Ave., St. Louis, Mo., Laclede-Christy Clay Products Co.
Koji Fujioka, Shofu Porcelain Mfg. Co., Kyoto, Japan.
M. S. Gifford, Lake Bluff, Ill.
William Gardner, Gardner Feldspar Co., Hartington, Ontario, Canada.
A. H. Goodman, Box 915, Pittsburgh, Pa.
George M. Grady, 74 Pacemont Rd., Columbus, Ohio.
John L. Greenwood, Lehigh Sewer Pipe & Tile Co., Lehigh, Iowa.
Park Hitchins, 1447 Oliver Bldg., Pittsburgh, Pa.
Sidney H. Ivery, 4432 Gibson Ave., St. Louis, Mo.
William J. Johnson, 4148 Langland St., Cincinnati, Ohio.
Y. Kitamura, Shofu Kogo Kafushiki Kaisha, Kyoto, Japan.
E. W. Koering, Crystal Ave., Vineland, N. J.
Charles E. Kraus, 110 W. 40th St., New York, N. Y.
George J. Lawrence, J. B. Ford Co., Wyandotte, Mich.
Arthur T. Leahy, 5490 Ellis Ave., Chicago, Ill.
William H. Marr, % Canadian Libbey-Owens Sheet Glass Co., Hamilton, Ont., Canada.
J. J. Miller, % Nesbit & Bollen, 403 Liberty Ave., Pittsburgh, Pa.
Leon W. Mitchell, Rock Island, Ill., Rock Island Stove Co.
W. O. Mitscherling, % Atlas Powder Co., Wilmington, Del.
Knud Y. Chr. Moller, 4956 McPherson Ave., St. Louis, Mo.
F. H. Nies, Cor. Hamilton Ave. & Summit St., Brooklyn, N. Y.
K. Okura, 84 Kobayashi-Cho, Nagoya, Japan.
J. Clair Peck, 4961 Neosho St., St. Louis, Mo.
W. Pendrup, Coonley Mfg. Co., Cicero, Ill.
Frank J. Pohs, 1097 Interstate Ave., Portland, Ore.
E. K. Proodian, Newtown, Bucks Co., Pa.
H. M. Pulsifer, Manhattan Bldg., Chicago, Ill.
Paul Q. Quay, Lake Shore Blvd., Euclid, Ohio.
G. W. Rathjens, 6100 Dorchester Ave., Chicago, Ill.
W. H. Reid, 10 Stanley Pl., Yonkers, N. Y.
Cedric L. Rennieburgh, A. C. Spark Plug Co., Flint, Mich.
J. E. Thompson, 2507 Townsend Ave., Detroit, Mich.

John F. R. Villalta, Apartado No. 65, Barcelona, Spain.
William J. Vodick, 1733 Lake Ave., Wilmette, Ill., Chicago Hardware Foundry Co.
Frank A. Weidman, 38 S. Dearborn St., Chicago, Ill., Inland Steel Co.
E. J. Winkleman, Box 1122, Pittsburgh, Pa.
Miles M. Zoller, 208 S. LaSalle St., Chicago, Ill.

PITTSBURGH SECTION MEETING

The annual business meeting and election of officers for the Pittsburgh Local Section of the SOCIETY was announced for the evening of January 22, 1924. Following a dinner served at the University of Pittsburgh Cafeteria, the meeting was to take place at Mellon Institute. A four-reel motion picture, "The Story of Refractories," was to be shown prepared by the U. S. Bureau of Mines and Laclede-Christy Company.[1]

DETROIT SECTION MEETING[1]

The Time: January 22nd Dinner at 6:30 P.M.
Lecture at 8:00 P.M.
The Place: Elk's Club
The Speaker: A. V. Bleininger (internationally known authority on refractories).
The Subject: "The Properties of Refractories from a Physical and Chemical Standpoint."

This talk will be presented in a clear concise form which anyone can understand, and will follow up Mr. Bleininger's first talk on "Specifications for Refractories." This will be followed later by a third talk entitled, "Specifications for Refractories Used in the Metallurgical Industries." At a fourth meeting a five-reel motion picture showing in detail the manufacture and applications of refractories to the industries will be presented.

CHICAGO LOCAL SECTION

Election of officers of the Chicago Section of the AMERICAN CERAMIC SOCIETY was held in Chicago, December 15, 1923, at the Morrison Hotel. The officers for the new year are:

President: H. C. Beasley, Supt., Coonley Mfg. Co., Chicago.
Vice-President: William Knowles, Titanium Alloys Co., Chicago.
Secretary-Treasurer: R. A. Rahn, Leveltown Potteries, Chicago.
Councilor: C. W. Parmelee, Ceramics Dept., University of Illinois.
Papers were read by L. H. Menne and W. A. Hull.

WANTED: AN ANALYTICAL SECTION

BY H. H. STEPHENSON

On coming to this country one received many impressions of which the first was pleasure at the high quality of the ware produced, and the second a mild surprise at the scarcity of works laboratories and the very moderate salaries paid to chemists.

[1] Received in Secretary's office, January 15, 1924.

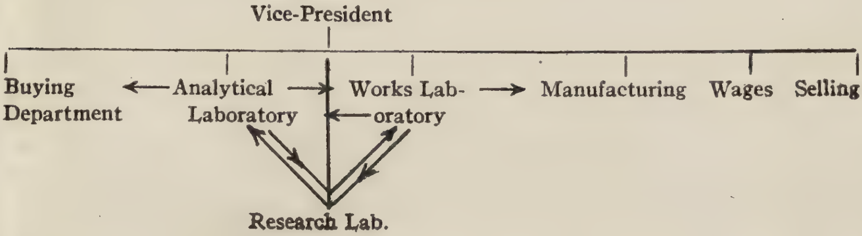
The legend in Europe is that American research has infinite financial resources behind it.

It is of my third and fourth impressions that I wish to speak, and these concern (*a*) purchase of raw materials, (*b*) loss in manufacture.

The answer to both lies in the analytical laboratory.

Raw Materials.—The very first analysis I did in this country of an important, ingredient delivered in bulk at a plant showed that the material was hopelessly inferior, and we obtained a letter of "explanation" from the sellers. In England there would have been a law case with some hundred dollars for a few minutes chemical evidence on the stand. But nothing happened. The manufacturer seemed to think it natural to pay a good price for a 40% adulterated article.

The following scheme shows the rightful position of the chemists:—



The purchase of a raw material should be conducted on rigid lines: Vice-President initials list of sellers. Buying department asks for quotations and samples. Chemist analyzes them and reports on the purity, on the presence of harmful impurities, and on the price calculated to 100% purity. Vice-President decides, and a specification is made out to govern the bulk delivery according to sample. Immediately the consignment has reached the plant, and before the sale is completed, the chemist makes a representative sample and analyzes it. If not up to the original, the consignment is returned at seller's expense.

I take "yellow oxide" of uranium (sodium uranate), though any example on a large scale would do as well.

Sample A at $3 a pound, Sample B at $4, Sample C at $5.

A contains 45.27% $Na_2U_2O_7$
B contains 70.84%
C contains 93.96%

The remainder in all cases being sodium carbonate with less than one per cent of non-harmful impurities.

At 100% $Na_2U_2O_7$, A costs $6.62, B costs $5.64, and C $5.32 is cheapest and is ordered. Bulk deliveries were 90.22 and 90.92% $Na_2U_2O_7$. C is satisfactory.

This is the only method by which a manufacturer can get 100% efficiency in his purchasing department, and it excludes graft. The reader is doubtless aware that in England there is a law against an employee of one firm taking a commission from another firm. A conviction under that law would hardly be possible without the assistance of the analytical chemists.

Loss in manufacture in this country is certainly twice the loss in European plants, though most firms are in the happy position of being able to ignore it. I have heard it said that the American workman, unlike the American middle class and unlike any class in the old country, puts his wages before his work, but even if that were true it would not be true when a family heritage of the potter's craft has had time to get es-

tablished. Nor can it be attributed to methods of burning. The American kiln is as efficient as the European.

Thus we come back to the variation of raw materials. A hundred ton lot of feldspar should have exactly the same composition in every bag and in every part of every bag.

The facts are, therefore, that an analytical laboratory can halve the loss in manufacture, and take anything from ten to 40% off the cost of raw materials. What is on the debit side? The equipment of a laboratory, $500, and the salary of a chemist, $3000.

An analytical section is wanted to put this across to the manufacturers, to standardize the construction of ceramic laboratories, to coördinate the activities of committees and societies on specifications, and to strengthen the legitimate position of the analytical chemist.

SUMMER MEETING OF THE SOCIETY

Interesting trip to Pacific Coast, July 21–Aug. 16

Following out their plan of "seeing America First" the members of the AMERICAN CERAMIC SOCIETY will leave Chicago on the evening of July 21, 1924 for a four weeks' trip to the Pacific Coast. From Spokane, Wash. and Puget Sound on the north to the southern part of California, members will have the opportunity of seeing both the development and enthusiasm of the western ceramic industries and also one of the most beautiful sections of the country. A more satisfying trip for the SOCIETY has never been given and never before have the plans been laid so carefully and matured so early as for this inviting trip.

With Chicago as the central starting point, members will gather from the eastern and central states and leave on a private train for Spokane, Washington.[1] The committees of the Pacific Northwest, San Francisco and Los Angeles are already announced and have completed many plans for the comfort and entertainment of the visitors.

In Washington stopovers and visits will be made at Spokane, Freeman, Mica, and Seattle and Auburn. Sight-seeing trips will be made to Mt. Rainier and on Puget Sound. California stopovers will include, Lincoln, San Francisco, Merced, El Portal, Yosemite Valley and Los Angeles and vicinity.

The return trip will be made by any of the transcontinental routes selected by the members and no effort will be made to return to Chicago as a party. A stopover may be made at Grand Canyon if desired.

Summer tourist rates have been secured making the approximate railroad fare including side trips $200.00. This does not include food or hotel expenses.

Early reservations must be made to the Secretary's office, Lord Hall, O. S. U., Columbus, Ohio. These must be in the office on or before June 1.

The Local Committees announced for the western states are as follows:

F. B. Ortman, Tropico Potteries, Glendale, Cal., *General Chairman.*

Pacific Northwest: Hewitt Wilson, University of Washington; Samuel Geijsbeek, Geijsbeek Engineering Co., Seattle, Wash.; Paul S. Mac Michael, Northern Clay Co., Auburn, Wash. (Members to be named.)

Los Angeles: Findlay Drummond, Alberhill Coal and Clay Company, *Chairman.* (Members to be named.)

[1] A private train will be secured if 125 members sign up for the trip. Otherwise private coaches will be secured.

San Francisco: A. L. Gladding, Gladding, McBean and Co., *Chairman;* J. T. Roberts, Stockton Fire Brick Company; N. A. Dickey, Livermore Fire Brick Company; Otto Rosenstein or Kenneth M. Henry, Illinois-Pacific Glass Company; W. Newton Stearns or W. A. Potter, Pacific Porcelain Ware Company.

OBITUARIES

Lemon Parker

Lemon Parker, 67 years old, president of the Parker-Russell Mining and Manufacturing Co., 3314 Morganford road, died of heart disease today at his home, 3413 Oak Hill Avenue, St. Louis, Mo. He had been ill two years and had not been active in business for some time.

Mr. Parker was an active member of the SOCIETY since 1904, and an ever loyal supporter of the SOCIETY. He will be remembered as the originator of the load test at high temperatures. His early experiments are described in Volume 7, p. 185 of the *Transactions* of this SOCIETY published in 1904.

Oscar B. Scherer

Word has been received of the recent death of Oscar B. Scherer, of 5 N. Karlov Ave., Chicago, Ill. Mr. Scherer has been a member of this SOCIETY for a number of years and was known among the enamel manufacturers.

NOTES AND NEWS

MEETINGS OF POTTERY SUPERINTENDENTS AND FOREMEN IN EAST LIVERPOOL, OHIO

There have been held two meetings of the newly formed association of pottery executives. The first meeting has already been reported.[1] The second one held, December 14th, in the rooms of the Potters' Association was a still more pronounced success, there being present about 80 men. At this meeting a number of the working rules governing the relation between the manufacturers and the operative potters were discussed in detail. The desire was expressed that more uniform practices be adopted in dealing with the men. Several problems submitted in the question box which has been made a feature of all programs were given lengthy consideration. With the development of the field of activity of this organization it is certain that future meetings will be crowded with pressing questions. One of the most desirable and pleasing features is the opportunity thus afforded the men from the different plants to become acquainted in the pleasant surroundings of the club. Through the courtesy of the U. S. Bureau of Mines a film was shown which gave the story of refractories as illustrated by the operations of the Laclede-Christy Clay Products Co.

WORK OF THE RESEARCH COMMITTEE OF THE U. S. POTTERS' ASSOCIATION

During the past year the Association has maintained a fellow at the Bureau of Standards, Washington, D. C., who has nearly completed his work. The investigation deals with the study of facts relating to crazing, with particular reference to the thermal

[1] *Bull. Amer. Ceram. Soc.*, **2** [12], 397 (1923).

expansion of the body and glazes, the effect of heat treatment, thickness of the glaze, mechanical strength of body and glaze and effect of the firing upon the microstructure of the body. Already some facts have been accumulated which show that the usual conceptions as to the relation between body and glaze are in error. The work will be completed as soon as possible which should be within the next two months and reported to the Association.

Besides this work the committee has reported upon several subjects, such as sagger preparation, refractories, crazing and the strength of sagger mixes in the dried and fired state. At the present time the activities of the organization are confined to the research mentioned above, at the Bureau of Standards, the study of the sagger question and an investigation of the Texas kaolin. The last-named topic has come up for consideration because of the report that large deposits of this material are actually available at the present time, reports which seem to be substantiated. It is expected that twelve potteries will take part in the work of testing out the Texas clay in a practical way.

CLAY PRODUCTS COURSE ADDED AT STATE COLLEGE

For the first time in Pennsylvania history, young men of the state desiring to make the clay working industries their life profession, will now be able to secure a higher education in ceramic engineering without finding it necessary to go to another state. President John M. Thomas today announced the appointment of J. B. Shaw as head of the newly created department of ceramic engineering at the Pennsylvania State College.

Pennsylvania stands second of all states in the value of its yearly output of clay products, including brick, tile, terra cotta and fine clay pottery, totaling over $31,000,000. There are almost 1000 separate clay working industries in the state employing over 12,000 wage earners. Ceramic engineers have been drawn by these industries from colleges in New Jersey, New York and Ohio, but within the next few weeks young Pennsylvanians anxious to train for this important field will be able to enroll as ceramic students in a four year training course in the Penn State School of Mines, where the second semester starts on January 28.

J. B. Shaw

For many years State College has had demands for ceramic engineers. The new department was authorized by trustees several months ago, and after a long search Professor Shaw was secured as the proper man to take charge. He has been professor of ceramics at the New York State College of Ceramics, at Alfred, N. Y., for eight years. He was graduated as a clay products, or ceramic engineer, at Ohio State University, and has had fifteen years of experience in that field.

The location of this course at State College is fortunate, for throughout central Pennsylvania there is a wide diversity of clay, glass sand, ganister and other plants within easy reach of the college. The college maintains a well equipped laboratory, and the teaching of the subject in the mining school with its geology department is another special advantage.

REPRINTS FROM ANNUAL TABLES

The Secretary-General of Annual Tables announces that the following list of reprints from Volume IV is available for sale at the prices indicated.

	Pages	Price (Fr. francs) Paper	Bound
"Spectroscopy," by M. L. Brüninghaus. Preface by A. Fowler, F. R. S.	210	35	45
"Electricity, Magnetism, Conductivity of Electrolytes, Electromotive Forces," by MM. Malapert, v. Weisse, R. E. Slade and G. L. Higgen. Preface by F. B. Jewett	144	30	40
"Radioactivity, Electronics, Ionization of Gases," etc. by MM. J. Saphores and F. Bourion. Preface by by Sir E. Rutherford, F. R. S.	19	10	18
"Crystallography and Mineralogy," by L. J. Spencer. Preface by Sir Henry A. Miers, F. R. S.	65	15	25
"Biology," by E. Terroine and H. Colin. Preface by Jacques Loeb	37	12	20
"Engineering and Metallurgy," by L. Descroix. Preface by G. K. Burgess	154	30	40
"Colloids," by E. Rebière. Preface by Jacques Duclaux	9	6	12

These reprints contain all of the data for the subjects indicated which are found in Volume IV of Annual Tables, which volume covers the literature of the world for the years 1913 to 1916, inclusive. Specialists having occasion to refer frequently to data in the fields covered by any of these reprints will find them invaluable for ready reference, and at the present rate of exchange the cost of these reprints is very small.

Members of any of the organizations listed below are entitled to a 50% discount on the prices given above.

Orders for any of these reprints should be sent direct to Dr. Charles Marie, 9 Rue de Bagneux, Paris 6, and should be accompanied by an international money order or a draft on Paris covering the price of the reprint plus two francs for postage and packing on each order.

National Academy of Sciences
Philosophical Society of Washington
American Philosophical Society
American Academy of Arts and Sciences
American Association for the Advancement of Science
American Institute of Chemical Engineers
American Institute of Electrical Engineers
American Electrochemical Society
American Chemical Society
AMERICAN CERAMIC SOCIETY
American Society of Civil Engineers
American Society of Mechanical Engineers
American Society for Testing Materials
American Institute of Mining and Metallurgical Engineers

EXPERIMENTAL DATA LOST

Shinzo Satoh, of the Toyko Electric Company, Kawasaki, Japan and a member of this SOCIETY has written to friends of his loss in the recent earthquake. Mr. Satoh narrowly escaped death when his laboratory collapsed and he was badly injured. All of the data which he had gathered through several years of experiments and studies were lost.

PROPOSED INVESTIGATIONS IN HEAT TRANSMISSION

Division of Engineering, National Research Council: Objects

1. To provide designing, operating, and research engineers with reliable information on heat transmission in as simple and convenient shape as is compatible with accuracy.

2. To analyze theoretical and experimental data already published or otherwise available so as to get them into usable form.

3. To induce the general adoption of a standardized heat transmission research objective to the end that all new research will be conducted in such a way that it will yield generally valuable information.

It is proposed that a suitable committee be organized under the auspices of the National Research Council and the work divided among six sub-committees, namely, publicity; bibliography; theory, nomenclature and definitions; temperature measurements; heat transmission of insulating and building materials, and heat transmission between fluids and solids.

The first work proposed is the critical review of material already published which could be considered in the light of an audit. It is proposed that each article be properly classified, and the material in it abstracted and rearranged in accordance with an approved outline. Critical comments bringing out conclusions in addition to or at variance with the authors will be kept in mind. It is proposed that the full time services of a competent engineer be engaged in this work under the direction of the committee.

Need for Investigations

Heat transmission is in an unsatisfactory state. There is the greatest need for quantitative information that can safely be generalized, for coördination of present knowledge, and for coördination of future work. The nature of this work is executive, editorial and advisory. The establishment of a research laboratory is not contemplated and full use will be made of all present research facilities. The aim is to make present knowledge available in its most usable form, to direct attention to specific items wherein present knowledge fails us, to indicate how future investigations may rectify these faults, and, finally, through publicity, to encourage heat transmission research in accordance with the standards set by the proposed committee on Heat Transmission.

BUREAU OF STANDARDS NOTES

Factors Affecting the Resistance of Tank Block to Glass Attack

Probably one of the most annoying sources of trouble to manufacturers of commercial glass on a large scale is the lining of the glass melting tanks. Very frequently these linings fail through corrosion after 10 to 14 months' service which results in a considerable loss of time and money. A life of 20 to 24 months for such a lining is not considered an unreasonable service to expect. Since the need for better tank refractories is so generally felt the Bureau has deter-

mined to conduct an investigation covering the various typical brands now used to determine, if possible, the relation between refractory composition, conditions of service and life. In order to get the investigation under way 27 small tanks have been made using refractories which are typical of dense and open burned aluminous and siliceous brands, as well as brands of medium composition. These will be subjected to the corrosive action of a soda-lime glass at high temperatures and the reactions obtained will be correlated, if possible, with the various types of refractories used.

A Study of the Factors Affecting the Life of Boiler Setting Refractories The need has been felt for a long time of a better test covering the resistance of boiler setting refractories to slagging. Although the investigations which the Bureau has carried out on refractories for the development of specifications have shown that the service can be predicted with fair accuracy from the results of certain tests, it seems desirable to develop a laboratory slag test in order that factors of composition, both of the slag and refractory and their comparative effect on the life of brick, may be determined. The apparatus necessary for carrying out such a test has been designed and constructed and it is proposed to observe the effect of high, medium and low fusing clinker on various brands of refractories. Test panels of the brick to be investigated will be brought to a high temperature by means of a blast impinging on the brick. Finely ground and artificially prepared clinker will be introduced into the flame and in this way brought into contact with the test panel.

STANDARDIZATION, THE BULWARK OF STRENGTH AND PROGRESS OF INDUSTRIES IN GERMANY

Standardization of industrial production has been one of the important factors in enabling Germany to maintain its industrial machine intact, in the face of the multitude of obstacles now confronting that country.

"The extent to which Germany has so far succeeded in keeping her industrial machine intact, is due in no small part to the elaborate scale on which her standardization work is performed," it is stated by Dr. P. G. Agnew, Secretary of the American Engineering Standards Committee, who recently returned from Europe, where for two months he made a study of the standardization movement and the manner in which European developments in this direction are likely to affect American industry.

"The elaborateness of the organization for the work, its activity, and the scale on which it is being carried out constitute a new development in industrial organization.

"Practically every important manufacturing concern in Germany is officially participating in the industrial standardization program of that country. More than a thousand German companies have formal standardization organizations within their own works. These organizations are called 'standards bureaus.' The larger firms have branch bureaus in the separate departments, or in the separate factories. One of the well known companies has twenty-one such branch bureaus, employing in all a special staff of more than one hundred. Another firm has a permanent full-time staff of over two hundred in its various branch bureaus. In all of the great firms the bureau reports directly to the general manager."

The extent to which industrial life in Germany has been coördinated, it is stated, is shown by the fact that more than seven hundred German national standards have been adopted. This includes only those in which several different industries are concerned, and which are approved by the central national body. These include fundamental engineering standards as: standard diameters, tapers, sizes of keys, threads,

fits, etc.; materials, tools, measuring instruments and gages, machine parts, including handles, ball and journal bearings, etc.; gears, and sizes of paper.

In addition to this work of the central body, and closely correlated with it are no less than sixty-five special industry committees actively working on such subjects as: the standardization of pipe fittings, piping, and accessories, welding, steel construction, concrete and reinforced concrete, fire fighting equipment, windows, doors and stairways, foundry practice, the printing trades, merchant marine, locomotives, motor trucks, laboratory apparatus, photographic supplies, non-ferrous metals, precision tools, sand, gravel and street paving material, typewriters, highway bridges, rolling mills, and railway car construction.

A striking example is cited of the efficiency of national standardization as it has been developed in Germany, in the case of a rush order placed with German manufacturers for 200 locomotives for delivery to Russia. "Production of different parts was allotted to seventeen different manufacturers to be produced strictly upon the plan of interchangeable parts, no one manufacturer making a complete locomotive. No serious practical difficulty was encountered in filling the order. The inspectors made a particularly striking test of the feasibility and accuracy of the plan by ordering a complete locomotive to be assembled from parts chosen at random from the parts furnished by the seventeen manufacturers. It proved to be ready for service immediately after assembly without the necessity of any disassembling for readjustment.

Standardization engineering is now a recognized profession in Germany. The rapid development of standardization organizations within the companies has made a large demand for such work. Advertisements for standardization engineers and for such positions regularly appear in the engineering press.

An interesting development of the last few years is the appearance of consulting engineering firms specializing in standardization work. There are now five such firms in Germany. This work is closely connected with industrial or efficiency engineering, in which there is now great and growing interest in Germany. In general, it appears to be much more closely connected with the movement for industrial standardization than is the case in this country. The largest of these firms devotes about half of its time to standardization work, employing a staff of over forty. They have as their clients trade associations as well as individual firms, the latter including both large and small companies.

One of their clients is the trade association representing the motor vehicle industry. In this work they perform many of the services that would be done by an ordinary headquarters standardization staff.

Of the companies which are their clients, some maintain their own standards bureaus, which take care of the greater part of the detailed work, leaving to the consulting firm only the more important and difficult questions. In other cases, the consulting firm does a large amount of the detailed work.

Another most interesting development is the work of consulting engineers on trade catalogs for companies. This is particularly significant, as it is carrying standardization a step farther than is usual, by introducing it into the sales organization and sales policy. In this, careful consideration is given to the question of limiting the number of types, ranges and sizes offered for sale, placing proper emphasis in the catalog on these particular items on which the company wishes to concentrate, and, in general, in featuring and often advertising the relation of the firm's products to the standardization movement.

CALENDAR OF CONVENTIONS[1]

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 4–9, 1924	Atlantic City
(Summer Meeting)	July 21–Aug. 16, 1924	Trip to Pacific Coast
American Concrete Institute	Feb. 25–28, 1924	Chicago
American Institute of Electrical Engineers	Feb. 4–7, 1924	Philadelphia
American Zinc Institute	May, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	April 18, 1924	Washington, D. C.
Common Brick Mfrs. Assn. of America	Feb. 11, 1924	Los Angeles, Calif.
Institute of Metals, Div. of American Institute of Mining and Metallurgical Engineers	Feb., 1924	New York City
Natl. Assn. of Stove Mfrs.	May 7–8, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	April 27, 1924	Atlantic City
Natl. Brick Mfrs. Assn.	Jan. 28–Feb. 2, 1924	Cincinnati, Ohio
Natl. Builders Supply Assn., Inc.	Feb. 11, 12, 1924	St. Louis, Mo.
Natl. Electric Light Assn.	May or June, 1924	
Penna. Gas Assn.	April, 1924	Atlantic City
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	April or May, 1924	(?)
Western Society of Engineers	June 4, 1924	Chicago

[1] Further information may be secured through the Chamber of Commerce of U. S., Washington, and World's Convention Dates, New York, N. Y.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Vol. 3 | March, 1924 | No. 3

EDITORIAL

OUR LEADERS

How to Find Facts
How to Recognize Facts
How to Use Facts

February was the birthday month of two of America's foremost leaders, George Washington and Abraham Lincoln. The thought from the lives of these two men to be developed here is that at all times throughout their youth and their later years of service, they were in constant studious application of fact-finding and using. School days were not their limit of time devoted to study.

Such is the record of every man who is successful through his own efforts. It is the untiring and "always at it" application that makes big industrial successes from small beginnings. It requires a continual drive to find, to recognize and to use facts.

A University graduate employed by a concrete contracting concern applied to this office for information on calculation of openings in revolving screens. He had not learned how to find facts. He probably will never know how to recognize facts and to use facts, largely because he had no plan for working diligently and systematically; he was not educated and was making no effort to acquire an education.

Education can be summed up in this three-fold formula of how to find, how to recognize and how to use facts. This is why schooled-trained men have no monopoly on education, and at the same time, it is the cause for so many college graduates being without an *education*.

"Broke at Fifty" is the title of a story written by R. L. Dollings of his eighty million dollar failure. His opening paragraphs have as their central thought that being broke at 13 or 22 when you are physically most fit, and when fear is an unknown quantity, and when the beckon of adventure is more than welcomed is not so serious a matter, but being broke at 50 is really serious. At fifty the machine is worn, some of the assurance is gone; "hesitation has succeeded the dash of impulse" and the nearness of the inevitable rainy day is evidenced by "just a mist at first and only a few scattered clouds, and you think you are as fit as ever, but life is the old story of the prize ring—the good old man will always go down before the good young man."

What a warning, what a sermon by one who by experience knows. But Youth will not be told; he will not take heed. It will be the oft repeated story of neglected use of Youth's opportunities and fitness to acquire.

The big idea of the AMERICAN CERAMIC SOCIETY is to inspire and to assist young men to acquire the education of how to find, to recognize and to use facts so that when he reaches the age when his faculties are less keen and his ability to acquire habits is very much less, he will have acquired the educational habit and impetus for which and only for which salaries are paid. The SOCIETY not only aims to furnish the inspiration but also the assistance in the acquiring of these fact finding and using requisites. It is for mutual help in furnishing the inspiration and assistance which no one laboring alone could acquire that the members of the SOCIETY are collaborating.

General Washington learned the importance of united effort. He influenced the writing of this lesson into the Constitution of the United States. President Lincoln's prime motive was preservation of this Union of effort. The principle holds in educational affairs as it does in statesmanship.

PAPERS AND DISCUSSIONS

A DUST COLLECTING SYSTEM[1]

By B. E. Whitesell

ABSTRACT

This paper describes the principle on which a dust collecting system installed at the Salina Plant of the Kier Fire Brick Co., Pittsburgh, Pa., operates. It also includes some of the factors considered in the designing and a description of the installation and operation.

Principle on Which the System is Based

Dust-laden air can be conveyed through pipes by connecting them to an exhaust fan, the fineness and specific gravity of the dust determining the velocity head necessary to convey the dust to the point desired. The volume of air required to carry the dust depends on the size of the dust particles and weight per cubic inch, as well as the dust hood necessary to retain the dust at its source.

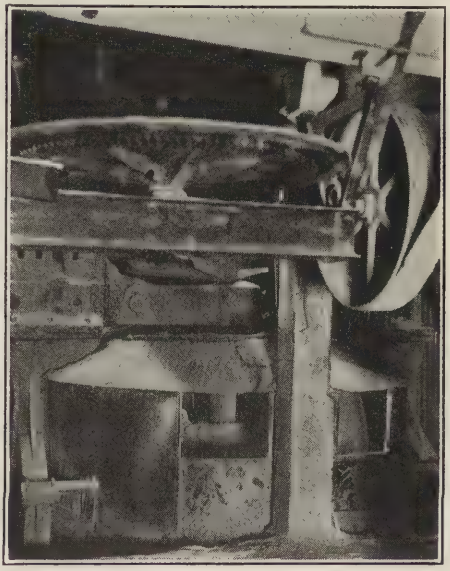


Fig. 1.

For a given fan, piping system and density of air, the following relations hold: cubic feet of air per minute (c.f.m.) varies as the revolutions per minute (r.p.m.); pressure α (r.p.m.)^2; brake horsepower (b.h.p.) α (r.p.m.)^3. It is evident, then, that the less air handled, the less h. p. will be required. In order that the most benefit may be derived from this fact, under working conditions, dampers are installed near the fans and bins so that any part of the system not in use can be shut off, resulting in a still further decrease of h. p. required, as this portion of the air is not handled.

The proper place to collect the dust is at its source, since the more it is allowed to spread the more air that must be handled and purified; and since the volume of air and its required velocity determine the size of pipes a system permitting of smaller pipes, simplicity, efficiency, and less cost to install and operate would result. The cost of installation increases in direct ratio to the volume of air handled.

[1] Recd. Dec. 29, 1924. Presented at the Atlantic City Meeting, February, 1924. (Refractories Division.)

By providing a means of dust separation (the arrester in this case) the air velocity through such is reduced below that value of velocity head that will move or carry the dust, thus depositing it in the bins of the arrester. Again, if baffle plates are used to reduce the air velocity, the settling action or separation of dust and air is increased.

Fig. 2.

The arrester screens being of suitable mesh, the remaining fine particles of dust are taken from the air, leaving it clean as it passes to the outside or is returned to the building for heating purposes.

Designing

This system was designed to take care of four dry pans and three plastic clay bins.

The hoods over the dry pans were designed so that the dust would be confined in the smallest space possible. They were also made as tight as working conditions would permit so as to limit the amount of air entering in order to concentrate, as much as possible, the dust content per cu. ft. of air. The first hood constructed is shown in Fig. 1. A better construction and the one recommended is shown in Figs. 2 and 3, this hood being simpler to build and permitting of easier removal for repairs to the dry pan.

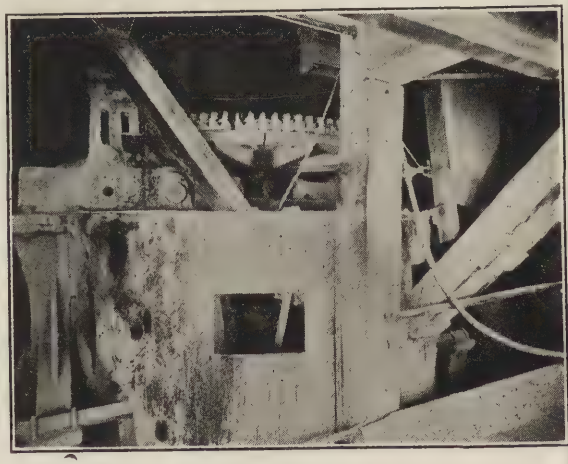


Fig. 3.

Careful consideration was given to the amount of dust that would be handled; the size of particles, in order to reduce the rate of abrasion in the galvanized steel pipes, together with an equally important value, namely, as little

loss as possible in friction in order to make the whole installation cost a minimum h. p. operation; and to the static pressure lost in the entire system.

Considering all the above items, the selection of the proper size arrester, fan and pipes is very important.

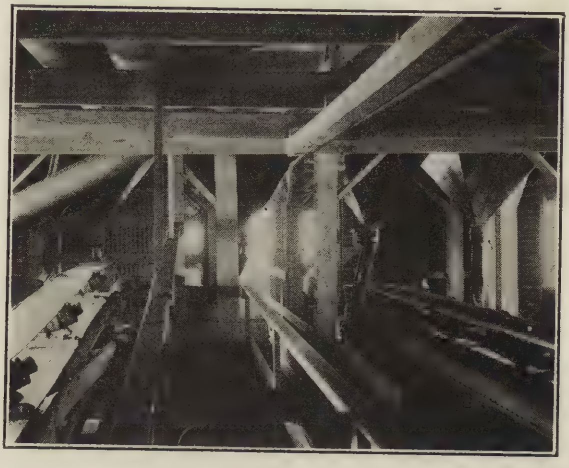


Fig. 4.

Description of Arrester

The arrester is manufactured by the W. W. Sly Manufacturing Co., Cleveland, Ohio.

It is of the cloth screen type containing large areas of filtering surface confined in a comparatively small space.

Cloth is claimed by the manufacturers to be a better filtering medium and should be fairly open so as not to produce too much back pressure. The threads should be fine as possible to make the weave loose and durable. The loose fibers on the individual threads, or the nap of the cloth, make the air passages so fine that practically the smallest particle of dust will be retained.

Fig. 5.

Each screen, being 9 feet by 3 feet $4^3/_8$ inches, is double, which gives it an area of 60 square feet. Since there are four screens to the running foot and the arrester is 18 feet long, there is a total screen area of 4320 square feet.

The greater the filtering or screen area in proportion to the volume of air, the looser the dust will lie on the cloth, which is important because the velocity of the air through the cloth should be low so that none of the dust will be drawn into the meshes, but will form a very loose and

fluffy layer on the surface without obstructing the passages of air to any great extent. Also, the screen will retain its filtering capacity longer without shaking the dust down.

The removal of dust accumulation from the screens is accomplished by a rapping device direct driven from a 1 h. p., 1200 r.p.m. motor.

The arrester, the inside dimensions of which are 9 feet $10^5/_8$ inches high plus 3 feet 10 inches for the hoppers, 7 feet 10 inches wide and 18 feet long, is divided into two sections, an 8-foot section and a 10-foot section. The 8-foot section collects from the pan grinding plastic clay and three plastic clay bins, while the 10-foot section collects from the three pans grinding the mixes for the brick machines.

Location of Arrester

The arrester is located directly over two storage bins which permits the hoppers of the arrester to be emptied directly into the bins. The location can be seen in Figs. 4 and 5.

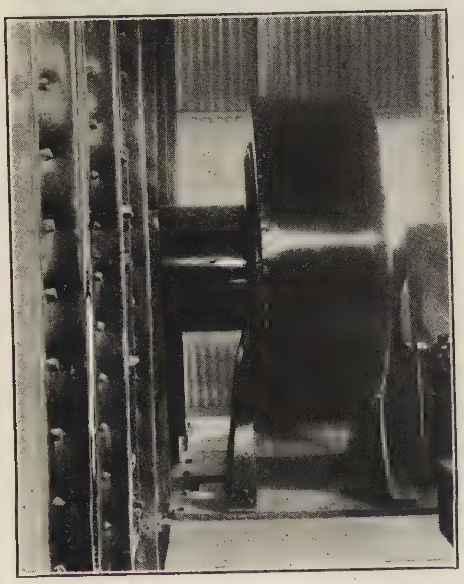


FIG. 6.

Fan

A No. 23 ES special steel plate exhaust fan, made by the American Blower Company, was chosen. It has a large diameter wheel of proper blast area to handle approximately 12,000 c.f.m. operating at 780 r.p.m., requiring under this condition 18.8 h. p. measured at 70°. The fan is shown in Fig. 6.

A type ES, 20 h. p., 1160 r.p.m. Westinghouse motor, having an 8-inch diam. pulley is used to drive the fan.

Pipes

The size of the pipes or branches necessary to carry the dust from the dry pans was first determined.

Each of the plastic clay bins is provided with a 7-inch pipe or branch; each of the dry pans grinding the standard mixes, consisting of flint clay ground to 3-mesh and finer, plastic clay of 30-mesh and finer, and grog or crushed brick bats, is provided with a 9-inch branch; while the pan grinding plastic clay and fire clay to 30-mesh and finer has a 10-inch pipe leading from it to the plastic clay side of the arrester.

These three branches from the bins are connected to a main pipe.

At each point where a branch enters the main, the main pipe area is increased an amount equal to that of the branch added, so that this main pipe increases from 7 inches at the farthest point from the arrester to 13 inches where it enters the arrester. This main also leads to the plastic clay section of the arrester. The three 9-inch branches from the dry pans are connected to a main whose smallest diameter is 9 inches and the largest diameter (the point where it enters the arrester) being 17 inches. This pipe enters the other section of the arrester. Fig. 7 shows the three main pipes entering the arrester.

Besides being designed with the easiest elbow turns (45° or less), as few angles as possible are used.

The main pipes are made of 20 ga. galvanized steel and the branches of 22 ga. All joints are riveted and soldered, keeping the bottom side level.

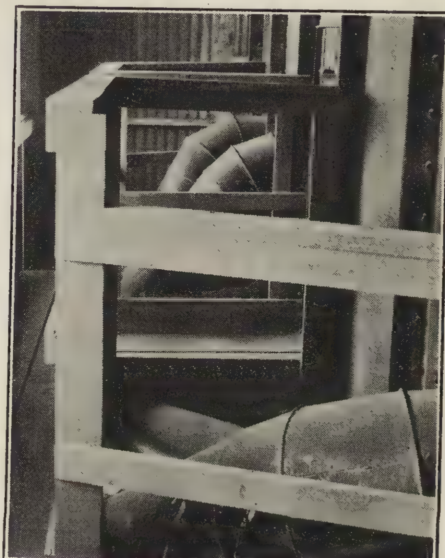


Fig. 7.

Operation

The man in charge of the clay distributing belt has charge of the dust arrester. About ten minutes of his time is required to look after the arrester and motor each day, except one day each week when he inspects the entire system. This requires about one hour.

In the evening, after the day's run, the fan is stopped and the rapping device is run for three minutes to shake the fine dust from the screens. If the fan is running while the screens are being rapped there is a tendency for the dust to be drawn through the cloth into the clean air side of the arrester. After rapping the screens, the gates at the bottom of the hoppers are opened and the hoppers allowed to empty, the plastic clay emptying into a plastic clay bin and the standard mix emptying into a flint clay bin by gravity.

The system is then ready for operation the following morning.

Remarks

It is difficult to get the average amount of dust collected daily, since the plastic clay dust will vary from 150 to 400 pounds for eight hours and the standard mixes from 120 to 180 pounds per pan for eight hours, depend-

ing on the condition of the clay as it enters the pan and the amount of water added in the pan. The clay contains enough moisture when it leaves the pans so that it can be conveyed to the machines by conveyors and chutes without causing any dust. In an operation where no water is added the amount of dust collected would be considerably increased.

Between 450 and 500 pounds of dust are collected during the ten hours required for the grinding of one car of fire clay.

Screen analyses show that 99%+ passes through a 200-mesh screen and 100% through a 150-mesh.

The system has been in operation thirteen months and the only expense has been the repainting of the inside of the arrester. This was done while a thorough inspection was being made of the entire equipment.

THE KIER FIRE BRICK CO.
PITTSBURGH, PA.

BUREAU OF ENGINEERING SPECIFICATIONS, LENSES AND GLOBES[1]

General Specifications

1. General Specifications for the Inspection of Material, issued by the Navy Department, in effect at the date of opening of bids, shall form part of these specifications.

Classes and Grades

2. Glassware furnished under these specifications shall conform to the following classes and grades, as specified in the requisition or schedule.

CLASS 1

NAVY STANDARD FRESNAL LENSES

Grade	
A	Clear
B	Red
C	Green
D	Blue

CLASS 3

NAVY STANDARD GLASSWARE

Grade	
F	Translucent
G	Red globes
H	Green globes
I	Blue globes

CLASS 2

Grade

E for Navy Standard heat resisting clear globes

Material, Workmanship, etc.

3. The material and workmanship shall be first class in every particular. The terms "Lead glass," "Lime glass," "Zinc glass," "Zinc-borosilicate glass," "Borosilicate glass," and "First class workmanship," as referred to in these specifications, shall be defined as follows:

[1] Received Dec. 1, 1923. Presented at the Atlantic City Meeting, February, 1924. (Glass Division.)

(*a*) *Lead glass.* A glass composition which contains not less than 22% of lead oxide in the finished lens, and whose specific gravity is not less than 2.90.

(*b*) *Lime glass.* A glass composition which contains between 3.5% and 5% of lime (CaO) and less than 15% of lead oxide in the finished glassware and whose specific gravity is not less than 2.60.

(*c*) *Zinc glass.* A glass composition which contains between 12% and 15% of zinc oxide (ZnO), less than 15% of lead oxide, is free from any appreciable lime (CaO) in the finished glassware, and whose specific gravity is not less than 2.60.

(*d*) *Zinc-borosilicate glass.* A glass composition which contains not less than 7.5% of boric anhydride and between 13% and 15% of zinc oxide in the finished glassware, and whose specific gravity is not less than 2.50.

(*e*) *Borosilicate glass.* A straight boric anhydride glass containing not less than 13% of boric anhydride, not more than 1.5% of aluminum and iron oxides, and free from all other metallic oxides. The specific gravity shall be not less than 2.28. This glass is for Class 2 (heat resisting) glassware only.

(*f*) *Workmanship.* First class workmanship shall mean, among other things, that all finished glassware shall be free from air bubbles, striae, wrinkles, mold marks, chipped edges or any other blemishes which may affect its optical qualities, mechanical strength or good appearance; uniformity in the thickness of illuminating glassware, uniformity in the color density of all colored glassware, and a uniform refractive index for all glassware of the same class and grade furnished under one contract; and having finished dimensions coming well within the tolerances specified on the drawing.

General Requirements

4(*a*) All glassware shall be in strict accordance with the Navy drawings specified in the requisition, order or schedule.

(*b*) Where the thickness tolerances are not shown on the drawing a variation of 12% above or below the nominal dimension will be permitted, provided, however, that this tolerance shall in no case exceed 1/16 inch. Where the tolerances are shown on the drawing the permissible variation shall be within the limits shown thereon.

(*c*) The edges of all lenses, globes or shades shall be either ground or molded to a true surface.

(*d*) The refractive index of the glass for any purpose is optional with the manufacturer but this index shall be uniform for that product. The manufacturer shall state to what index base the calculation of the lens contour has been developed, in the design of the Fresnal lenses. This

information shall be furnished the Inspector when material under a Navy contract or order is submitted for inspection.

(*e*) Glassware shall be in strict conformity with Tables I and II hereunder, with respect to color density and light transmission. Table I is given in terms of the actual transmission of light in percentage of the light source, on the basis of the candlepower standard. Table II is based on the standards of the Railway Signal Association at 100%.

(*f*) All colored glassware shall be of uniform color density per millimeter thickness, and the glass shall be solid color. Flashed glass will not be satisfactory.

TABLE I

TRANSMISSION IN ACTUAL PER CENT OF LIGHT SOURCE ON CANDLEPOWER BASIS

Class	Grade	Type	Per cent normal	Per cent maximum	Per cent minimum	Per cent deterioration after 1 year service
1	A	Navy Standard Clear	95	100	90	10
1	B	Navy Standard Red	7.5	9.4	5.6	20
1	C	Navy Standard Green	2.75	3.5	1.75	25
1	D	Navy Standard Blue (L. V.)	0.75	0.90	0.60	25
2	E	Navy Standard Clear (H. R.)	0.80	87	70	15
3	F	Navy Standard Translucent	65	100	50	10
3	G	Navy Standard Red Globes	9.35	10	7.5	20
3	H	Navy Standard Green Globes	11.6	12.5	10	25
3	I	Navy Standard Blue Globes (L. V.)	0.75	0.90	0.60	25

TABLE II

TRANSMISSION ON BASIS OF RAILWAY SIGNAL ASSOCIATION 100% STANDARD

Base 100% Red = 9.35% Actual Transmission
Base 100% Green = 11.6% Actual Transmission

Class	Grade	Type	Standard	Light limit	Dark limit
1	A	Navy Standard Clear	...	...	...
	B	Navy Standard Red	100%	100	60
	C	Navy Standard Green	100%	30	15
	D	Navy Standard Blue (L. V.)	...	...	...
2	E	Navy Standard Clear (H. R.)	...	...	...
3	F	Navy Standard Translucent	...	...	...
	G	Navy Standard Red Globes	100%	107.7	86.2
	H	Navy Standard Green Globes	100%	106.9	80.2
	I	Navy Standard Blue Globes (L. V.)	...	...	...

(*g*) All glassware furnished under these specifications shall have the manufacturer's name or trademark permanently impressed in each piece. In the case of Lenses (Class 1) this marking shall be made in the central zone or bull's eye. Heat resisting globes (Class 2) shall have this marking on the outer surface of the globe, near the edge. Globes for general illumination (Class 3) shall have this marking molded or pressed on one edge.

Detail Requirements

Class 1. Lenses

5(*a*)1. Fresnal lenses for navigational and signal lights. The glass shall be of such composition as to withstand the action of the elements, particularly that of salt water, without etching, discoloration, change in the color density of colored lenses, or any change in the light transmission of the finished glassware beyond the limits specified in paragraph 4(*e*) of these specifications.

(*a*)2. Clear, green and blue lenses (Grades A, C and D) shall be made from the best quality of lead glass.

(*a*)3. Red lenses (Grade B) shall be of the so-called selenium red glass and shall be made from the best quality of zinc-borosilicate glass.

(*a*)4. Fresnal lenses shall be designed to have a central bull's-eye and 4 zones above and 4 below this central zone. The mathematical design of the lens shall be such as to produce not more than an 8° dispersion above or below the horizontal axis of the central bull's-eye when used with a standard 40 watt incandescent lamp located at the focus of the system. Actual figuring of this design shall be at the option of the manufacturer as to the surface curvatures, spacing of zones, width of zones, etc., and the statement of the mathematical derivation of this design will not be required to be furnished by the manufacturer.

(*a*)5. The design of the system as a Fresnal lens shall be such that the rays emitted by a light source of a $^1/_4$″ sphere, placed at the focus of the system and passing through the system, shall emerge parallel. When the lens, with the above type of light source, is viewed at a distance of 20 feet along the horizontal axis of the bull's eye the zones shall all appear equally illuminated, the light showing through the zones as an uninterrupted vertical strip about $^1/_4$″ wide, for the entire height of the lens.

(*a*)6. Lenses shall be so designed and constructed as to be capable of withstanding an external hydrostatic pressure of 100 pounds per square inch indefinitely, when mounted in a support so designed as to produce a minimum strain on the lens.

(*a*)7. The several grades of glassware (A, B, C and D) furnished under Class 1 shall be subject to the following individual grade requirements:

(I) *Grade A—Clear.* The glass shall be free from perceptible tint when viewed through the lens. The entire visible spectrum of the light source shall be transmitted with color selection at any wave-length being kept below $^1/_2$ of 1%. The light transmission shall be in accordance with Table I.

(II) *Grade B—Red.* The glass shall be of such color quality that all light of shorter wave-length than 0.630 micron shall be absorbed, transmitting only red and orange light. All rays emitted by the sodium flame shall be completely absorbed. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(III) *Grade C—Green.* The glass shall be of such color quality as to absorb all of the light of longer wave-length than 0.570 micron, transmitting only violet, blue and green light. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(IV) *Grade D—Blue.* The glass shall be of such color quality that all light of longer wave-length than 0.489 micron shall be absorbed, transmitting only violet and blue light. The glass shall not, under any condition of light source, transmit any red or yellow light. The color density and light transmission shall be in conformity with Table I of these specifications. The glass of the lens shall, when used with a 25-watt standard tungsten lamp operating at rated voltage, show a direct visibility not to exceed 1000 yards; and, the indirect reflected rays shall not be visible over 200 yards on a dark night with a clear atmosphere.

Class 2. Heat Resisting Globes

5(*b*)1. *Grade E.* The glass shall be of a special heat resisting type and shall have an extremely low temperature coefficient of expansion. The unmounted heat resisting globe shall be capable of withstanding the internal stresses produced when the globe is heated uniformly to a temperature of 150°C and then suddenly and completely, or partly, immersed in water at 10°C, or, it shall be capable of withstanding a sudden change in temperature of 140°C. Under this treatment the glass shall not be injured in any way, either visibly or structurally. It shall be capable of withstanding this treatment repeated indefinitely.

(*b*)2. The glass shall be either a "Lead glass" or a "Borosilicate glass." It shall be of such composition as to withstand the action of the elements, particularly that of salt water, without etching, discoloration, or any change in the light transmission of the finished glassware beyond the limits specified hereunder.

(*b*)3. The glass shall be clear as to light transmission and it shall show

a light absorption not to exceed 4% for white light, nor a selective absorption exceeding 1/2 of 1% for any wave-length between 0.420 micron (violet) and 0.680 micron (red).

(*b*)4. The glass shall be suitable for use as an outer globe in a fixture in which a filter lens (Class 1—clear, red, green or blue—see paragraph 5(*a*)1 to 5(*a*)7, incl.) is used, without materially affecting the total light transmission of the assembly. When used with a filter lens, which lens in itself complies with these specifications, the combination shall show a light transmission within the limits of Tables I and II for the particular grade and color of lens with which the heat resisting globe is used.

(*b*)5. The glass shall be reasonably free from striae, bubbles, wrinkles or other defects which may be considered detrimental to its appearance, optical qualities or serviceability. The glass shall be of such mechanical strength as to render it capable of withstanding for an indefinite period, a continuous or fluctuating external hydrostatic pressure of 300 pounds per square inch, when permanently mounted in the fixture in which it is designed to be used.

Class 3. Globes

5(*c*)1. The glassware under this class may be of any stable commercial glass composition excepting a zinc glass. It shall be of such composition and quality as to withstand the atmospheric sea conditions which exist below deck without etching, discoloration or a change in color density or light transmission beyond the limits specified in Tables I and II.

(*c*)2. Globes or shades shall show no defined dead spots when illuminated from the inside and viewed from the outside. The glassware shall be of uniform thickness, within the tolerances specified.

(*c*)3. *Grade F—Translucent.* The translucent glass shall be of a totally diffusing milk glass, of uniform density, and shall be so made as to break up the light and eliminate any light source image. The glass shall transmit the entire spectrum, with absorptive selection in the red end of the spectrum desirable but not imperative. The light transmission shall be in accordance with Table I of these specifications.

(*c*)4. *Grade G—Red.* The glass shall be of such color quality that all light of shorter wave-length than 0.630 micron shall be absorbed, transmitting only red and orange light. All rays emitted by the sodium flame shall be completely absorbed. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(*c*)5. *Grade H—Green.* The glass shall be of such color quality as to absorb all of the light of longer wave-length than 0.570 micron, transmitting only violet, blue and green light. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(*c*)6. *Grade I—Blue.* The glass shall be of such color quality that all light of longer wave-length than 0.489 micron shall be absorbed, trans-

mitting only violet and blue light. The glass shall not, under any condition of light source, transmit any red or yellow light. The color density and light transmission shall be in conformity with Table I of these specifications. The glass of the globes shall, when used with a 25-watt standard Tungsten lamp operating at rated voltage, show a direct visibility not to exceed 1000 yards; and, the indirect reflected rays shall not be visible over 200 yards on a dark night with a clear atmosphere.

Method of Inspection, Tests, etc.

6. Inspection at the place of manufacture shall consist of the following:

(*a*) *Dimensional and Surface Inspection.* Each piece of glassware submitted for inspection under a contract or order shall be subjected to a careful inspection to ascertain that the dimensions are within the specified

TABLE III

No. of samples	No. of pieces of same type, class and grade, submitted in one lot or fraction thereof
1	25
2	100
3	200
4	500
5	1000
6	1500
7	2000
8	5000
10	10000

NOTE: The samples referred to in the above table refer only to glassware which is satisfactory to the Inspector as regards dimensions and workmanship. For samples which refer to rejected material under controversy see paragraph 8(*d*) of these specifications.

tolerances and that the workmanship is first class in every particular. The naval inspector concerned shall be the judge as to the size and number of small bubbles, striae, mold marks, wrinkles, chipped edges or other slight blemishes which are sufficient to detract appreciably from the serviceability of the lens or globe.

(*b*) *Specimens for Laboratory Tests.* Lenses or globes, to the quantity indicated in Table III hereunder, shall be selected by the Naval Inspector for forwarding to the Government Laboratory designated by the Bureau concerned. The samples shall be selected after the dimensional and surface inspection referred to in sub-paragraph 6(*a*) above has been made and they shall represent the poorest of the lot which, in the Inspector's judgment, are otherwise acceptable. No two samples shall come from the same pot of molten material.

(*c*) *Color Density and Light Transmission Tests.*

(I) *Lenses* (*Class 1*). The tests for light transmission of a lens shall be made on the basis of the average of transmission. Tests shall be

made by illuminating the entire lens and photometrically reading the transmission of light. Color density shall be rated likewise, the spectrum analysis being taken with the entire lens illuminated and the spectroscope placed at a distance which will bring the entire lens into the field of the spectroscope.

(II) *Globes (Classes 2 and 3).* The testing of glassware under Classes 2 and 3, for color density and light transmission, shall be made on a section of the globe, taking various photometric and spectroscopic measurements on sections 1″ in diameter by blocking off the remainder of the globe. The transmission and spectral values for all sections or zones shall fall within the limits of Tables I and II of these specifications. The appearance of dead streaks in any of the material, even though the tested zones fall within the specified limits of transmission, shall be cause for the rejection of the material.

(*d*) *Chemical Analysis and Weathering Tests.* Chemical analysis shall be made of the material of the samples, to ascertain that the composition is in conformity with these specifications. Weathering tests covering a one-year period of time shall also be made when, in the opinion of the Government Laboratory concerned, there is reason to question the suitability of a particular glass composition for the service intended. Acceptance of material submitted under contract or order will not, however, be contingent upon the result of such tests unless there be grave doubt upon this point, in which case the contractor will be required to make out a special guarantee to cover a period of one year.

(*e*) Any further tests which, in the judgment of the Bureau concerned, are necessary to ascertain that the material submitted is in full conformity with these specifications.

Packing and Marking of Shipments

7(*a*) Glassware shall be suitably packed for shipment in strong wooden cases or barrels. The method of packing shall be such as to prevent breakage, chipping or marring of the glassware during shipment. Each lens, globe or shade shall be individually wrapped in paper of the color corresponding to the color of the glass.

(*b*) All packing cases shall be plainly marked with the manufacturer's name, the contract, requisition or order number, the quantity, and the class and grade as defined in paragraph 2 of these specifications.

Notes to Supply Officers, Bidders, Manufacturers and Others

8(*a*) All requisitions, schedules or orders shall specify the Class and Grade as defined in paragraph 2 of these specifications, and the number of the Navy Drawing, or Drawings, which apply.

(*b*) Bids for furnishing glassware differing from the requirements of these specifications will be considered, provided the bidder clearly describes in his bid the specific points in which the glassware he proposes to furnish differs from the requirements of the specifications, and provided further that the differences are indicated as such. When exceptions are not clearly described and indicated as such it will be assumed that bidders are offering glassware in strict accordance with these specifications.

(*c*) Government purchases of glassware under these specifications shall cover not less than 25 pieces of each type on order. By "each type" is meant all lenses or globes made to the same drawing and coming within the same grade classification. Refer to paragraph 2 of these specifications.

(*d*) In the event of a controversy between the contractor and the naval inspector relative to the acceptability of lenses or globes which contain slight striae, bubbles, mold marks or wrinkles, the procedure which is to be followed by the contractor in making an appeal shall be as follows: the inspector shall select one or more samples for forwarding to a government laboratory to be designated by the Bureau concerned. The sample or samples so selected shall represent the poorest specimens of the lot of glassware under controversy. The selected samples shall be marked by the inspector in such a way as to positively preclude any chance of substitution and are then to be shipped by the contractor, at his own expense, to the government laboratory designated. The Laboratory will investigate the effect of such blemishes upon the serviceability of the material in question and render its report to the inspector, a copy of such report, with recommendations, to be forwarded to the Bureau concerned for its information. In the interim between the forwarding of such controversial samples to the Government Laboratory and the receipt by the inspector of a test report therefrom, the material involved at the contractor's works shall have the status of rejected material, and any delay in deliveries under the navy contract or order shall not be attributable to the government. An appeal from the Inspector's decision, the proper procedure for which is outlined above, is to be considered in the light of a privilege conferred by the Bureau concerned, which privilege may be withdrawn whenever, in its judgment, withdrawal is considered desirable.

(*e*) Copies of these specifications may be obtained upon application to the Bureau of Engineering, Navy Dept., Washington, D. C.

REFRACTORIES QUESTION BOX

E. E. AYARS, EDITOR

Contributed discussions covering questions of interest to the refractories manufacturer and consumer will appear each month in this department. A list of questions, some of which were considered at the last annual

meeting, is printed herewith. The membership is requested to submit additional questions and to contribute to the discussion of such questions as they have information on. It is planned to give one or more questions a thorough treatment each month. Anyone wishing to submit discussions will send them to the office of the General Secretary properly marked for this department. Author's name should be signed, but may be withheld if requested.

Question: What is the value of the poidometer to a manufacturer of refractories?

(1) The poidometer may be used to feed material at a uniform rate to a pan, pug mill, or other machine.

(2) The poidometer is a continuous machine, that is not intermittent in its operation, and measures materials accurately by weight, therefore two or more poidometers may be used to advantage to properly proportion materials to be mixed as they are fed to a pan or pug mill.

(3) The poidometer is adapted to feed ground fire clay at a uniform rate to a pug mill feeding an auger machine, from which auger machine a column of uniform stiffness is desired.

(4) The poidometer is also furnished, when desired, with a water attachment, which furnishes water at a uniform rate for mixing with the clay.

(5) This water attachment, when desired, can also be connected to the parts controlling the flow of clay so that any change in density in the clay due to its change in moisture content may be compensated for by an increase or a decrease in the water supply as needed.

(6) Manufacturers of fire brick ship ground fire clay and manufacturers of silica brick, silica cement, and the poidometer may be used to weigh these materials continuously as they pass from the grinding equipment to the railroad cars in which they are loaded. We contemplate at this time purchasing a poidometer for use in weighing ground fire clay.

S. M. Kier. Pres., Kier Fire Brick Co., Pittsburgh, Pa.

Discussion on Cupola Bricks:

1. Should a cupola block be hard burned?
2. Will a repressed cupola block give better service than a hand-made block?
3. Is it better to use a high-grade bond clay or a low-grade bond clay in cupola blocks?
4. If cupola blocks come from the kiln soft, does it affect their wearing qualities to reburn them in the kilns?
5. What fusion point is desirable in a cupola block?

One of the first requirements for cupola blocks is that they be hard burned.

As a rule, machine made and repressed brick are more uniform in size and shape than hand-made blocks. This, of course, is an advantage, and if there is no pronounced tendency to lamination the repressed brick will give the better service.

If a high-grade bond clay is used, very little or no flint clay will be required. A block made of high grade bond clay and grog without any flint clay will give better service than a block made of a low grade bond clay with a larger percentage of flint clay added.

The writer is not convinced that a reburned fire clay shape is as good as one which has been properly burned the first time. We can give no theoretical explanation for this, but it has been our experience that the reburned ware is liable to be inferior.

About cone 29 is a desirable fusion point for cupola blocks.

E. H. Van Schoick, Manager,
Chicago Retort and Fire Brick Co.,
Ottawa, Illinois

The service conditions to which a cupola block is subjected dictate whether or not it should be hard burned. Large cupolas as a rule require a hard-burned block, particularly in the car wheel foundry. There heavy scrap is charged with a large amount of flux and an all-day melting period is customary. Small cupolas pouring small castings, especially those on stove work, use a medium burned block. These installations have a short pouring period, being operated at a high temperature and pouring the metal very hot to get proper results with thin section castings. A hard-burned block under such conditions spalls badly.

The repressed cupola block is usually more uniform in size than the hand-made block, and will lay up with a much thinner joint. This is desirable, as it reduces the amount of patching caused by erosion and failure of joints.

There are four actions in the cupola which tend to destroy the fire brick lining (from *British Clayworker*).

(*a*) *Corrosion* of lining by furnace gases, fluxes, slag, fuel and molten metal.

(*b*) *Partial fusion* of brick in and near the hearth due to high temperatures.

(*c*) *Spalling* due to sudden temperature changes.

(*d*) *Abrasion* due to rubbing action of the descending charge.

Corrosion by slag is the main cause of failure. A porous brick should not be used, although a viscous slag will not attack a porous brick to any extent. A very fluid slag will attack almost any brick, especially one that is porous. This would indicate a hard-burned block in all cases.

Fusion is very slight. Spalling may be kept at a minimum by skilful furnace operation, even when very hard-burned and dense blocks are used.

Abrasion is usually slight and when hard blocks are laid up into a smooth wall with thin joints, it is not considered an important question. Abrasion

of a rough or patched wall is more or less severe in the case of large cupolas charging heavy scrap.

A refractoriness of cone 31 or over is considered desirable, although a lining with a fusion as low as cone 28 or 29 is satisfactory when the resistance to corrosion, spalling, etc. is suitable.

NOTE: Further discussion of this subject is solicited. Next Month: Discussion of refractories service in the air furnace.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

This is my first opportunity to address all members of the Society. To the 475 men and 72 ladies registered at the Convention in Atlantic City, I pledged to do all that may devolve upon me as President to further the interests of the Society during the 1924 fiscal year. I wish here to reaffirm this pledge and to make it known to all.

Election to presidency of so large and so potentially and dynamically a useful Society of ceramists is an honor but, of more concern to me, it is a call to service which carries responsibilities and privileges that have caused me to make a thoughtful survey of what we are and what we can become. In this survey is an estimate of what the President should be and should do, which estimate is almost appalling. I find comfort and reasons for expectation of a successful year in the fact that the Society is growing in potency through personal collaboration of an increasing number of earnest men and women. After all, the Society is not what the President, the Secretary or any of the other officers and trustees will it to be; it is just what the members make of it.

Well do I remember the organizing meeting of the Enamel Division. A few men, mostly college trained, met out of curiosity to learn to what extent representatives from competing concerns would disclose information. A real good fellowship and informing time was had. Experiences were exchanged. The meeting adjourned with nearly one hundred per cent conversion of those present to the value of meeting together for the purpose of discussing methods of production. As time passed the number attending and participating increased. The plant operators and college investigators learned a common language so that today the number of factory operators taking an active part has increased many fold.

Rather significant, I take it, that 63% of the 184 papers presented at the Convention just held were from plant operators. This shows an appreciation of the plant man for opportunity to exchange information and experiences.

But neither facts nor information are obtainable without paying a price either by bartering things of like kind or in the coin of the realm. The American Ceramic Society is the exchange market where he who wishes to succeed may, indeed it is almost a case where he must, seek opportunity to exchange the little that is new in his experience for the much which his fellow members give in exchange. This really is the mainspring the motive, the all-inspiring reason for the existence of the Society.

To so serve as President of this wonderful enterprise of mutual service that the growing confidence and interest will be accelerated at a greater rate during 1924, is my ambition. But I, after all, am only one of the members with a specially assigned task for the while. The burden of responsibility still rests with the members themselves.

MEMBERSHIP WORKERS' RECORD

On February 15, 1924, the grand total of membership in the Society was 2334. The number of personal members was 2030 and of corporations 304.

Our aim is to have each of these 2030 members intense workers for the Society coping actively with the ceramic problems and situations of the present day. The honor of holding a membership in the Society is betrayed unless that membership is used for vigorous coöperation.

	Individual	Corporation
R. R. Danielson	1	
I. A. Krusen	1	
R. F. Geller	1	
G. H. Brown	1	
Thos. A. Shegog	1	
Bruce F. Wagner	1	
Fred A. Harvey	2	
C. W. Parmelee	3	
J. M. Gilfillan	1	
Donald W. Ross	1	
James W. Moncrief	1	
Donald Hagar	1	
W. A. Potter	1	
R. F. Ferguson	1	
R. F. Segsworth	1	
K. H. Endell	1	
L. M. Moss	1	
August Staudt	1	
A. Malinovsky	1	
Robt. H. Armstrong	1	
C. C. Treischel	1	
Eugene J. Hysell	1	
G. W. Cruikshank		1
R. D. Landrum		1
Francis T. Owens		1
H. F. Staley		1
Office	15	4
	—	–
Total	40	8

NEW MEMBERS RECEIVED FROM JANUARY 15 TO FEBRUARY 15

PERSONAL

Armstrong, Chas. C., Mgr., The Armstrong Mfg. Co., Huntington, W. Va.

Bidleman, William J., Mine Supt. and Field Works, Wellsville Fire Brick Co., and Chicago Fire Brick Co., Wellsville, Mo.

Bowles, Fanny Belle, Bldg. 95, Walter Reed Hospital, Washington, D. C., Reconstruction Aide, U. S. Army.

Brown, Leroy Walton, 221 S. Cook Ave., Trenton, N. J., Supt., Lenox, Inc.

Budnikoff, Peter, Professor Engineer technolog of mineral technology, Ivanovo-Vosnesiensk near Moscow, Russia.

Carter, C. C., Supt., Buckeye Tile Co., Chillicothe, O.

Eccles, Alfred Livingston, 16 Atterbury Ave., Trenton, N. J., Sales Engineer, Fletcher Works, Philadelphia, Pa.

Foraker, Ralph L., 1918 S. 48 Court, Cicero, Ill., Ceramic and Efficiency Work, Coonley Mfg. Co.

Griffin, Paul Frederick, U. S. Refractories Corp., Mt. Union, Pa.

Griffiths, Norman, Chemist, Eureka Terra Cotta and Tile Co., Ballarat, Victoria, Australia.

Haldeman, Virgil Kenneth, 318–13th St., Beaver Falls, Pa., Ceramic Engineer, Beaver Falls Art Tile Co.

Harris, Robert W., Dillsboro, N. C., Secy., Harris Clay Co.

Heinle, Frederick John, 34 Highland Ave., Washington, Pa., Engineer, Hazel-Atlas Glass Co.

Horner, E. H., Box 314, Stockton, Calif., Supt., Stockton Fire Brick Co.

Hugill, William, Department of Applied Science, St. George's Square, Sheffield, England.

King, Walter F., Ceramic Engineer and Plant Supervisor, Mosaic Tile Co., Matawan, N. J.

Koehler, Walter A., 39 Maple Ave., Morgantown, W. Va., Instructor, Chemical Engineering, W. Va. University.

Koppers, Dr. Heinrich, Essen, Moltkestrasse 29, Germany.

Lahovsky, Josef, Chief Chemist of the Západceské Tovarny Kaolinové a samotivé, Horni Bitza, Czechoslovakia.

Lefranc, Jacques, 29C, Rue St. Martin, Paris III, Chief of Laboratory, Conservatoire Nationale des Arts et Metiers.

Longbotham, Harry, 1711 San Lorenzo Ave., Berkeley, Calif., Pacific Sanitary Mfg. Co.

Lu, Kai-Ching, Box 123, University Station, Urbana, Ill., Student Member.

Lyttle, Frobisher T., Scarsdale, N. Y., Art Potter, Scarsdale Kilns.

McLaughlin, N. H., Alsey, Ill., Secy., Alsey Brick & Tile Co.

Mathiasen, Alfred, Secretary, Matawan Tile Co., Matawan, N. J.

Millar, Charles A., c/o Ontario Sewer Pipe and Clay Products Co., Toronto, Ont.

Morris, Thomas H., 1104–8th St., Huntington, W. Va., Factory Mgr., The Charles Baldo Glass Co.

Navratiel, Hans, Beuthen/O.-S. Parallelstr. 6, Germany, Ceramic Engineer.

Porter, J. Barton, 1527 Spruce St., Philadelphia, Pa., Engineer, General Electric Co.

Putnam, LeRoy Edward, 1032 So. Grove St., Irvington, N. J., Sales Engineer, Celite Products Co.

Robertson, H. M., 600 Century Bldg., Cleveland, Ohio, Engineer, Robertson-Pease Co.

Seeley, Wm. E., 728 Crocker St., Los Angeles, Calif., Supt., Columbia Glass Co.

Spangler, C. P., 1514 Denniston Ave., Pittsburgh, Pa., Industrial Engineer, James Laughlin Steel Corp.

Tailby, Roland V., 224 Graham St., Highland Park, N. J., Ceramist, Matawan Tile Co.

Thompson, Franklin S., Sayerville, N. J., Ceramist, Sayer and Fisher Co.

Weiser, Franklin S., 45 Prospect St., Waterbury, Conn., Research Engineer, Scovill Mfg. Co.

Whitford, Alfred W., Watsontown, Pa., Ceramic Engineer, Fiske & Co., Inc.

Williams, J. C., 1300 Pennsylvania Ave., N. W., Washington, D. C., Manager, Development Service, Southern Railway Co.

Windolph, Frank S., 1509 N. Frazier St., Philadelphia, Pa., Secy., Chambers Bros. Co., Manufacturers of Brick-making Machinery.

Woodside, Frank C., 100 Northumberland Road, Pittsfield, Mass., Supt., Pittsfield Works, Porcelain Plant, General Electric Co.

CORPORATIONS

Bradford Brick & Tile Co., Face Brick, Hollow Tile, Bradford, Pa., W. L. Hanley, Jr.

J. W. Cruikshank Engineering Co., Glass Factory Engineers, 230 Fifth Ave., Pittsburgh, Pa.

The Detroit Vapor Stove Co., Mfrs. of Stoves, Detroit, Mich., Alvin G. Sherman, Genl. Mgr.

Geist Mfg. Co., Mfgs. and Sales, Fuel Oil Burners, 2001 Atlantic Ave., Atlantic City, N. J.

Hazleton Brick Co., Manufacturing Bricks, 211 Markle Bank Bldg., Hazleton, Pa., Mr. Friedlander, Pres.

Humphreys Mfg. Co., Manufacturers, Sanitary Enameled Iron Ware, Mansfield, Ohio., Frank B. Mahoney.

McLanahan-Watkins Co., Mining and Milling Cyanite, Charlotte Court House, Va.

Milton Pressed Brick Co., Face Brick Mfrs., Milton, Ont., F. R. McCannell, Vice-Pres.

PERSONAL NOTES OF MEMBERS

John L. Carruthers is at present in Los Angeles, Calif., where he is installing a kiln at the Los Angeles Pressed Brick Co. Mr. Carruthers' address is 419 Majestic Bldg., Columbus, Ohio.

Albert S. Adcock is living at 1999 Iuka Ave., Columbus, Ohio.

Harry Barkby, formerly of Wheeling, W. Va., is now situated at 466 Nishannock Ave., New Castle, Pa.

E. N. Bunting, who for a number of years has been instructor in ceramics at the University of Illinois, has taken a position with the Western Electric Co., 463 West St., New York City.

H. T. Bush, formerly of Toronto, is living at Inglebush, Port Hope, Ontario, Canada.

S. F. Cox writes that his address has been changed from 1011 Coal St., Wilkinsburg, Pa. to Box 320, Brackenridge, Pa.

Thomas Stanley Curtis, President of the Vitrefrax Company, lives at 583 So. Templeton St., Huntington Park, Calif.

M. R. Cuthbertson gives as his new address Box 131, Ancon, Canal Zone, Panama. Mr. Cuthbertson formerly was located at Oroya, Peru, S. A.

J. H. Eccles requests that his correspondence be addressed 32 Broughton Ave., Montreal West, Quebec.

The name of **The Ohio Pottery Company** recently has been changed to the **Fraunfelter China Company.**

Park Hitchens, whose name was listed among the "unknowns" in February, is employed by the General Refractories Company at Philadelphia, Pa.

William Gardner, formerly of Ontario, Canada, is now situated with the Cleveland Feldspar Co., 10220 Michigan Ave., Cleveland, Ohio.

James R. Goodwin, formerly of East Liverpool, Ohio, is now situated with the Mt. Clemens Pottery Co. and is living at Ashcraft Apts., No. 4, Little Road, R. F. D. No. 1, Mt. Clemens, Mich.

G. M. Grady gives 24 W. Frambes St., Columbus, Ohio as his correct address.

Carl B. Harrop has moved his office from S. Third St. to 419 Majestic Bldg., Columbus, Ohio. Associated with him are C. D. Bossert, Frank M. Hartford, W. E. Cramer and J. L. Carruthers.

Dr. Havas has moved from Heidelberg to Magyarovar, Hungaria.

Wynne L. Jackson has moved from 111 S. Kilpatrick Ave., Chicago, Illinois, to Central Hotel, Richmond, Calif.

F. M. Koenig is now located at 1005 Lincoln Place, Brooklyn, N. Y.

I. A. Krusen has left Danville, Illinois, where he has been employed with the General Refractories Co. and has gone to Rockmart, Ga. to assist in the reorganization of a fire brick company. Mr. Krusen will act as vice president and general manager of this company.

Thomas N. Kurtz has moved from Hollidaysburg, Pa. to the University Club, Pittsburgh, Pa.

Crawford Madeira has moved from 900 North American Bldg. to the Atlantic Bldg., Philadelphia, Pa.

D. Keith McAfee, formerly of Newcastle, Pa. has moved to 814 N. Seventh St., Cambridge, Ohio..

E. G. Menart has notified the Secretary's office that he has moved from Newark, Ohio, to 506 Fulton Road, N. W., Canton, Ohio.

R. S. Olsen, formerly 501 E. Daniel St., Champaign, Ill., has moved to 5073 N. Lincoln St., Chicago, Ill.

C. R. Peregrine is now general manager of the Marion, Indiana, office of the Macbeth-Evans Glass Company.

Carl Perg has informed the Secretary's office that his correct address is P. O. Box 727, Des Plaines, Illinois.

Richard E. Reif is living at 1004 W. Nevada Ave., Urbana, Ill.

W. D. Richardson has moved from Michigan Ave., to 1473 Belmont Ave., Columbus, Ohio. His business address is 312 Schultz Bldg.

V. J. Roehm has resigned his position as research ceramist for the United States Potters Association, and is holding a similar position with Homer-Laughlin China Co., Newell, W. Va.

Samuel Rusoff, formerly of Anderson, Ind., has moved to 833 Market St., Zanesville, Ohio.

Vincent P. Schildmeyer is living at 96 Albert St., St. Bernard, Ohio. Mr. Schildmeyer formerly lived in Cincinnati.

Edward Schramm requests that his mail be sent to the Onondaga Pottery Co., Syracuse, N. Y.

Carl Seiler, of the Roessler and Hasslacher Chemical Company, has moved from 1127 N. Calvert St. to Falls Station, P. O. Box No. 5, Baltimore, Md.

G. T. Stowe is located at 812 Finance Bldg., Cleveland, Ohio.

W. F. Wenning is now living in his new home, 3354 Francisco St., Pittsburgh, Pa.

E. J. Winkleman, a February "unknown," is located at Winkleman Engineering Co., 460 Union Trust Bldg., Pittsburgh, Penna.

Glenn D. Williams, of Worcester, Mass., is living at the Y. M. C. A., Box 607.

Eugenie A. Worman, of Seattle, Wash., has moved to 1630 Boylston St., Parker Apts.

J. W. Wright, formerly of Charleroi, Pa., writes that his address is now Irwin, Illinois, c/o R. W. Flemings.

OFFICERS FOR 1924

R. D. Landrum, President, Box 8, Station D, Cleveland, O.

R. M. Howe, Vice-President, Kier Fire Brick Co., Pittsburgh, Pa.

R. C. Purdy, Secretary, Lord Hall, O. S. U., Columbus, O.

H. B. Henderson, Treasurer, Standard Pyrometric Cones, 1538 N. High St. Columbus, Ohio.

Board of Trustees

A. F. Greaves-Walker, Stevens, Inc., Stevens Pottery, Ga.

F. H. Riddle, Champion Porcelain Co., Detroit, Mich.

Art Division: F. H. Rhead, American Encaustic Tiling Co., Zanesville, Ohio.

Enamel Division: R. R. Danielson, Bureau of Standards, Washington, D. C.

Glass Division: J. C. Hostetter, Corning Glass Works, Corning, N. Y.

Heavy Clay Products Division: C. Forrest Tefft, Fiske & Co., Inc., Watsontown, Pa.

Refractories Division: J. S. McDowell, Harbison-Walker Refractories Co.

Terra Cotta Division: R. L. Clare, Federal Terra Cotta Co., Woodbridge, N. J.

White Ware Division: C. C. Treischel, R. T. Vanderbilt Co., 50 E. 42nd St., New York City.

Divisions

Art: Miss Mary G. Sheerer, Chairman, Newcomb School of Pottery, New Orleans, La.; Miss Margaret K. Cable, Vice-Chairman, Assistant Professor, University of North Dakota, Grand Forks. N. D.; Herbert S. Kirk, Secretary, Universal Sanitary Mfg. Co., New Castle, Pa.

Enamel: R. R. Danielson, Chairman, Bureau of Standards, Washington, D. C.; H. G. Wolfram, Secretary, Bureau of Standards, Washington, D. C.

Glass: G. E. Barton, Chairman, 227 Pine St., Millville, N. J.; A. N. Finn, Secretary, Bureau of Standards, Washington, D. C.

Heavy Clay Products: F. T. Owens, Chairman, Fiske & Co., Inc., Watsontown, Pa.; John D. Martin, Vice-Chairman, Straitsville Impervious Brick Co., New Straitsville, Ohio; Amos P. Potts, Secretary, 118 E. Blaine St., Brazil, Ind.

Refractories: Fred A. Harvey, Chairman, U. S. Refractories Corporation, Mt. Union, Pa.; C. E. Bales, Vice-Chairman, Louisville Fire Brick Works, Highland Park, Ky.; R. F. Ferguson, Secretary, Mellon Institute, Pittsburgh, Pa.

Terra Cotta: W. D. Gates, Chairman, American Terra Cotta and Ceramic Co., 1808 Prairie Ave., Chicago, Ill.; B. S. Radcliffe, Secretary, Northwestern Terra Cotta Co., 2525 Clybourne Ave., Chicago, Ill.

White Ware: F. H. Riddle, Chairman, Champion Porcelain Co., Detroit, Mich.; C. C. Treischel, Secretary, R. T. Vanderbilt Co., 50 E. 42nd St., New York, N. Y.

H. B. HENDERSON, TREASURER OF THE AMERICAN CERAMIC SOCIETY

H. B. Henderson, recently elected treasurer of the AMERICAN CERAMIC SOCIETY was graduated from Ohio State University with the degree of Bachelor of Science in 1904. For the past eighteen years he has been employed with General Edward Orton

H. B. HENDERSON

H. G. WOLFRAM

in the manufacture of pyrometric cones, now serving as superintendent of the Standard Pyrometric Cone Company of Columbus, Ohio. Mr. Henderson has been a member of the SOCIETY since 1904 and an active member since 1917. Mr. Henderson has contributed to the *Transactions of the American Ceramic Society* and *Journal.*

H. G. WOLFRAM, NEW SECRETARY OF ENAMEL DIVISION

H. G. Wolfram, born Des Plaines, Illinois, 1896. 1915–1918, employed in enamel shop of Royal Enameling & Mfg. Co. (later Benjamin Electric & Mfg. Co.). 1918–1919. Private, 108 Eng. 33rd Div., A. E. F. Entered the University of Illinois, 1919,

and graduated with B. S. Degree in Ceramic Engineering, 1923. Since that time has been connected with the Enameled Metal Section, U. S. Bureau of Standards, Washington, D. C. Recently elected Secretary of the Enamel Division of the SOCIETY. Has contributed one article to the *Journal.*

TO EDIT REFRACTORIES QUESTION BOX

E. E. Ayars was born in Little Genesee, N. Y., 1894. Graduated from Alfred University, 1917, B.S. degree in Ceramic Engineering. Employed by American Refractories Co., Baltimore, 1917; U. S. Fuel Administration, Washington, D. C., 1918; Asst. Supt. American Refractories Co., Baltimore, 1919 and 1920; Supt., Danville, Ill., 1921, Devils Lake, Wis., 1922, Joliet, Ill., 1922–23. Mr. Ayars was engaged February 1st by the El Paso Brick Co., El Paso, Texas, to develop a fire brick from local refractory clays. Associate member AMERICAN CERAMIC SOCIETY, 1916. Active member, 1921. Chairman, Program Committee, Refractories, 1922, and Chairman Refractories Division, 1923. Editor of Refractories Question Box in the *Bulletin,* 1924. Contributed frequently to SOCIETY publications.

ERLING E. AYARS

C. C. TREISCHEL GOES TO R. T. VANDERBILT COMPANY

The Pottery Department of the R. T. Vanderbilt Company, which is in charge of Ira E. Sproat, announce that they have secured the services of Chester C. Treischel of the General Electric Company Potteries at Schenectady, N. Y. and Pittsfield, Mass., effective March 1.

Mr. Treischel is a graduate in Ceramic Engineering of the University of Illinois, and for the past six years has been associated with the General Electric Company. He is a well-known Ceramic Engineer, having been Secretary of the White Wares Division of the AMERICAN CERAMIC SOCIETY for the past three years and at the annual meeting of the SOCIETY in Atlantic City he was elected a Trustee of the SOCIETY.

NOTES AND NEWS

CERAMIC EXPERIMENT STATION NEWS

P. D. Helser Accepts Appointment Perry D. Helser has resigned his position as ceramic engineer with the A. C. Spark Plug Company of Flint, Mich., in which capacity he served for five years, to accept appointment to a similar position with the Department of the Interior, Bureau of Mines Ceramic Experiment Station at Columbus, Ohio effective February 1, 1924.

Mr. Helser enters the service of the Bureau especially well equipped to supervise several of the problems now under investigation both at the Columbus station and in the field.

Utilization of Mineral Cyanite There has recently been a coöperative agreement entered into with the Department of the Interior relative to the utilization of the mineral cyanite in the manufacture of refractory materials as well as in porcelain. This investigation will be conducted at the Bureau of Mines, Ceramic Experiment Station, Columbus, Ohio.

The mineral cyanite like andalusite, which is being successfully used in the ceramic industry, has the same composition as sillimanite but differs from it in mineral formation. The merits of the mineral sillimanite as a desirable ingredient in ceramic products are fairly well known. The resulting mineral formations if produced under the proper firing conditions, impart to the ware the properties of unusual resistance to sudden temperature changes, exceptionally high mechanical strength and greatly increased electrical insulation, at both normal and elevated temperatures.

When used in special refractories composed almost entirely of sillimanite, as far as some recent investigations have progressed, the results would indicate that such refractories will be well suited for use in the metallurgical field because of the high resistance to sudden temperature changes, the ability to stand up under load at elevated temperatures and because of the neutral nature of the material.

Ohio and Kentucky Fire Clays to be Investigated The U. S. Bureau of Mines upon request of the Refractories Manufacturers Association has agreed to make a survey of the burning conditions at plants manufacturing fire clay refractories in the Ohio and Kentucky field. The survey will be carried out under the direction of the superintendent of the Ceramic Experiment Station in coöperation with the Fuel Section of the Bureau and will include approximately twenty plants.

CERAMICS SHORT COURSE, UNIVERSITY OF ILLINOIS

The ceramic department of the University of Illinois, under the direction of C. W. Parmelee, professor of ceramic engineering and head of the department, conducted a successful short course in clay working and enameling, January 14–25, 1924. Prof. Parmelee was assisted by the following lecturers and instructors from the University of Illinois:

M. S. Ketchum, Dean of the College of Engineering and Director of the Engineering Experiment Station.

S. W. Parr, Professor of Applied Chemistry.

Morgan Brooks, Professor of Electrical Engineering.

E. B. Paine, Professor of Electrical Engineering.

O. A. Harker, Professor of Law.

E. W. Lehmann, Professor of Farm Mechanics.

B. W. Benedict, Manager of the Machine Shop Laboratories.

A. P. Kratz, Research Professor of Mechanical Engineering.

A. M. Buswell, Chief, Illinois State Water Survey.

R. K. Hursh, Associate Professor of Ceramic Engineering.

A. E. Drucker, Assistant Professor of Mining Engineering.

F. M. Porter, Assistant Professor of General Engineering Drawing.

F. E. RICHART, Research Assistant Professor of Theoretical and Applied Mechanics.

E. N. BUNTING, Research Associate in Ceramic Engineering.

C. H. CASBERG, Superintendent of the Machine Shop Laboratory.

T. N. MCVAY, Instructor in Ceramic Engineering.

R. T. WATKINS, Assistant in Ceramic Engineering.

E. G. BOURNE, Laboratory Demonstrator in Ceramic Engineering.

Visiting Lecturers were:

R. R. DANIELSON, U. S. Bureau of Standards, Washington, D. C.

R. M. HOWE, The Kier Fire Brick Company, Pittsburgh, Pa.

A. S. WATTS, Head of the Department of Ceramic Engineering, Ohio State University.

Lectures were given on the following subjects:

1. Origin and Properties of Clays. (Eight lectures.) Prof. Parmelee.
2. Elementary Physics and Chemistry. (Twelve lectures.) Dr. Bunting.
3. Explosives and Blasting. (One lecture, illustrated.) Prof. Drucker.
4. Business Law. (Two lectures.) Prof. Harker.
5. The Composition and Properties of Coal. (One lecture.) Prof. Park.
6. Steam Engines and Boilers. (Two lectures, illustrated.) Prof. Kratz.
7. Boiler Water. (One lecture, illustrated.) Prof. Buswell.
8. Dynamos and Motors. (Two lectures.) Prof. Paine.
9. Drying. (Four lectures.) Prof. Hursh.
10. Burning. (Four lectures.) Prof. Hursh.
11. The Use of Clay Products on the Farm. (One lecture.) Prof. Lehmann.
12. Maximum Production from Equipment. (One lecture.) Mr. Benedict.
13. Pyrometers. (Two lectures.) Mr. McVay.
14. Glazes. (Six lectures.) Prof. Parmelee.
15. Prospecting and Sampling. (One lecture.) Mr. McVay.
16. Periodic Kilns. (Two lectures.) Prof. Hursh.
17. Continuous Kilns. (One lecture.) Prof. Hursh.
18. Car Tunnel Kilns. (One lecture.) Prof. Hursh.
19. Care and Maintenance of Machinery. (One lecture, illustrated.) Mr. Casberg.
20. Physical Tests of Clay Products. (One lecture.) Prof. Richart.
21. Winning of Clays. (Two lectures.) Mr. McVay.
22. The Reading of Drawings. (Two lectures.) Prof. Porter.
23. Clay Haulage. (Two lectures.) Mr. McVay.
24. Lighting of Factories and Showrooms. (Two lectures.) Prof. Brooks.
25. Burning Brick for Color. (Two lectures.) Mr. McVay.
26. Fuel Economy. (One lecture.) Prof. Hursh.
27. Plant Problems. Prof. Hursh.
28. Dies and Auger Machines. (Two lectures.) Prof. Hursh.
29. Refractory Materials. (Four lectures.) Mr. Howe.
30. Vitreous Enamels. (Six lectures.) Mr. Danielson.
31. Bodies. (Four lectures.) Prof. Watts.
32. Grinding. (One lecture.) Mr. McVay.
33. Screenings. (One lecture.) Mr. McVay.

A very pleasant feature of the Short Course was a dinner tendered by those attending to the staff of lecturers. This dinner was presided over by Walter P. Woo of the Best Brick Company, Evansville, Indiana, who also arranged a very clever parod in which various members of the Short Course showed the staff of lecturers some of thei

foibles. This impromptu entertainment was very amusing and demonstrated that there was a good deal of talent among the group which had not been previously suspected.

Those who registered for this course were:

ALABAMA:

Geo. R. Houston, Birmingham Clay Products Co., Birmingham, Ala.
Ladd, T. E., Southern Refractories Co., Fort Payne, Ala.
Staley, E. L., Sheffield Brick Co., Sheffield Ala.

COLORADO:

LeRoy, Marz, Denver Terra Cotta Co. (Western Plant of the Northwestern Terra Cotta Co.), Denver, Colo.

CALIFORNIA:

Lacy, Roy, Pacific Clay Products Co., Los Angeles, Calif.
Sauters, T. E., Pacific Clay Products Co., Los Angeles, Calif.

ILLINOIS:

Sir, Walter, Chicago Pottery Co., 1924 Clybourne Ave., Chicago.
Cerny, J. J., Northwestern Terra Cotta Co., Cicero, Illinois.
Cruikshank, P. H., Mueller Mfg. Co., Decatur.
Hinman, R. B., Editorial Dept., Ceramic Industry, 407 So. Dearborn, Chicago.
Manley, Rowland Peoples Gas Light and Coke Co., Room 325, 122 So. Michigan Ave., Chicago.
Pegram, Jas., Jr., Carrollton, Illinois.
Starck, John A., Fulton Clay Pipe Factory, Fulton, Ill.
Wilcox, Geo. L., John Wilcox and Sons, McLean, Illinois.
Woare, Edw. M., Decatur Brick Mfg. Co., Decatur.
Wright, Everett, L., Decatur Brick Mfg. Co., Decatur.
Kamm, R. J., Highland Brick and Tile Co., Highland, Ill.
Roefer, C. M., Elgin, Illinois.
Babtist, Hugo, Springfield Paving Brick Co., Springfield, Ill.
Moose, J. E., Chemistry Department, University of Illinois.
Gaskin, T. D., Midland Terra Cotta Co., Chicago.
Carter, R. F., Peoria Brick and Tile Co., Peoria, Illinois.
Gauthier, Chas. B., 107 Blooming Bank Rd., Riverside, Illinois. (Research Engr., Western Electric Co.).

INDIANA:

Casey, J. B., Colfax Drain Tile Co., Crawfordsville, Ind.
Landers, Wm. F., Jr., United States Encaustic Tile Works, Indianapolis.
Wood, Walter, P., Best Brick Co., Evansville, Ind.

MISSOURI:

Guenther, William, Bridge and Beach Mfg. Co., St. Louis, Mo.
Bradley, R. S., A. P. Green Fire Brick Co., Mexico, Mo.
McCann, F. A., A. P. Green Fire Brick Co., Mexico, Mo.

OHIO:

Cornelius, V. R., Metropolitan Paving Brick Co., Canton, O.
McCallin, P. J., Metropolitan Paving Brick Co., Canton, O.
Yohe, L. C., Metropolitan Paving Brick Co., Canton, O.
Emig, W. R., Toledo Scale Co., Toledo, Ohio.

Lynn, Horace K., Summitville Face Brick Co., Summitville, O.
McNeil, Daniel W., The John Douglas Co., Cincinnati.
Schildmeyer, Vincent P., The Cincinnati Porcelain Co., Cincinnati, O.
Vormelker, Howard I., National Lamp Works of General Electric Co., East Cleveland, Ohio.
Ketchem, Edw. R., Estate Stove Co., Hamilton, O.
Dimmick, R. B., United Alloy Steel Corporation, Canton, O.

PENNSYLVANIA:

Clowes, Edwin A., McCullough-Dalzell Crucible Co., Pittsburgh.
Drummond, C. R., Fiske and Co., No. 5 Plant, Watsontown, Pa.
Seanor, J. G., Darlington Clay Products Co., Darlington, Pa.

TENNESSEE:

Harker, O. A., Jr., Dixie Brick and Tile Co., Puryear, Tenn.
Jackson, Walter H., Dixie Brick and Tile Co., Puryear, Tenn.
Murphy, Wayne F., Tennessee Enamel Mfg. Co., West Nashville, Tenn.

TEXAS:

Elders, Jno. A., Acme Brick Co., Millsap, Texas.
Kelly, J. W., Acme Brick Co., Denton, Texas.

KENTUCKY:

McDonald, P. C., Coral Ridge Clay Products Co., Louisville, Ky.

WISCONSIN:

Held, Henry J., Rundle Mfg. Co., Milwaukee, Wis.

IOWA CLAY PRODUCTS MANUFACTURERS

Convention and Short Course at Iowa State College

The members of the Iowa Clay Manufacturers Association met at Iowa State College for their Annual Convention and Short Course, February 14 and 15, 1924. The officers of the Association are:

President, Carl A. Reaver, Eldora Pipe and Tile Co., Eldora, Iowa.
Vice-President, W. A. Queale, Redfield Brick and Tile Co., Redfield, Iowa.
Treasurer, H. R. Straight, Adel Clay Products Co., Adel, Iowa.
Secretary, M. T. Straight, Adel Clay Products Co., Adel, Iowa.

The following program was presented during the two days convention and course of instruction. At the banquet which was held for the guests, each one was given a small matt glazed bowl of good workmanship and commercially perfect in quality, made from Iowa raw materials. These were presented by the Department of Ceramic Engineering, Iowa State College.

Program

1. Depreciation as a Factor in Production Cost, Dean Anson Marston, Iowa State College, Ames, Iowa.
2. Load-O-Grams, Starr E. Cogswell, Western Weighing and Inspection Bureau, Des Moines, Iowa.
3. Drain Tile Specifications and Testing, W. J. Schlick, Drainage Engr., Iowa State College, Ames, Iowa.

The Future of the Railroad Tunnel Kiln, H. R. Straight, Gen. Mgr., Adel Clay Products Co., Adel, Iowa.

5. Labor Saving Machinery, C. A. Thorp, Mechanical and Ceramic Engr., Des Moines, Iowa.
6. National Advertising Reflected in Economic Conditions, J. C. De Lay, Creston, Iowa.
7. Washing Iowa Coals, Prof. D. A. Moulton, Iowa State College, Ames, Iowa.
8. Selling Clay Products to the Building Material Dealer, C. B. Platt, Editor Permanent Construction, Des Moines, Iowa.
9. Simplification and Research, J. S. Sleeper, Hollow Tile Assn., Chicago, Ill.
10. Plant Operation, O. J. Whittemore, Sheffield Brick and Tile Co., Sheffield, Iowa.
11. Uses of Clay Products in Building Structures, Prof. A. H. Kimball, Iowa State College, Ames, Iowa.
12. The Outlook Ahead, John P. Wallace, Wallace's Farmer, Des Moines, Iowa.
13. Accounting Cost Control of Clay Products Plants, F. A. Guignon, Brick and Clay Record, Chicago, Ill.
14. Letters that Pull, Prof. A. Starbuck, Iowa State College, Ames, Iowa

Those attending the meeting were:

Alt, Leslie R., Sioux City Brick & Tile Co., Sioux City, Iowa
Bacon, E. C., Hollow Bldg. Tile Assn., Omaha, Nebraska
Barret, Wayne E., Adel Clay Products Co., Adel, Iowa
Bradshaw, E. P., Bradshaws Co., Fort Dodge, Iowa
Bristol, C. J., Globe Machinery Co., Des Moines, Iowa
Bucht, C. J., Boone Brick & Tile Co., Boone, Iowa
Carhart, F. F., Jackson Tile & Brick Co., Des Moines, Iowa
Chamber, J. T., Fate-Root-Heath Co., Plymouth, Ohio
Cogswell, Starr E., Western Weigh. and Inspection Bureau, Des Moines, Iowa
Cox, Paul E., Iowa State College, Ames, Iowa
Furman, M. C., Des Moines Brick & Tile Co., Des Moines, Iowa
Furness, J. H., Sheffield Brick & Tile Co., Sheffield, Iowa
Galvin, G. H., Rockford Brick & Tile Co., Rockford, Iowa
Green, John R., Northern Iowa Brick & Tile Co., Mason City, Iowa
Guignon, F. A., Brick & Clay Record, Chicago, Illinois
Irwin, W. J., Vincent Clay Products Co., Fort Dodge, Iowa
Jackson, W. L., Buckey Clay Products Co., Belle Plaine, Iowa
Johnson, S. C., Kalo Brick & Tile Co., Otho, Iowa
Love, J. P., Boone Brick & Tile Co., Boone, Iowa
McHose, Ray M., Nevada Brick & Tile Works, Nevada, Iowa
Martin, S. A., Centerville Brick Co., Centerville, Ia.
Miller, R. L., Green Tile & Brick Co., Cedar Rapids, Iowa
Neiswanzer, C. O., Standard Clay Products Co., Oskaloosa, Iowa
Page, D. C., Walter Bledsoe Co., Chicago, Illinois
Parks, J. G., Morey Clay Products Co., Ottumwa, Iowa
Pearse, F. D., National Clay Works, Mason City, Iowa
Platt, C. B., Platt Company, Des Moines, Iowa
Queale, W. A., Redfield Brick & Tile Co., Redfield, Iowa
Rawson, Cummins, Iowa Pipe and Tile Co., Des Moines, Iowa
Reaver, C. A., Eldora Pipe and Tile Co., Eldora, Iowa
Selby, Ralph L., Reliance Brick Co., Des Moines, Iowa
Schurr, Wm., Kalo Brick & Tile Co., Fort Dodge, Iowa
Sleeper, J. S., Hollow Bldg. Tile Assn., Chicago, Ill.

Souder, W. J., Des Moines Clay Co., Des Moines, Iowa
Straight, H. R., Adel Clay Products Co., Adel, Iowa
Straight, M. L., Adel Clay Products Co., Adel, Iowa
Strouse, H. S., Pawling & Harnischfeger Co., Milwaukee, Wisconsin
Tallman, J. L., Thew Shovel Co., Kansas City, Missouri
Taylor, Mark A., Vincent Clay Products Co., Fort Dodge, Iowa
Tearson, H. C., Maxwell, Iowa
Thorpe, Clyde A., Des Moines, Iowa
Tolbert, Geo. M., Iowa Pipe & Tile Co., Des Moines, Iowa
Tramp, H. L., Creston Brick & Tile Co., Creston, Iowa
Treble, Herbert, Natl. Clay Products Association, Chicago, Illinois
Tungate, Chas. M., Iowa Mach. and Supply Co., Des Moines, Iowa
Tulla, Ralph W., Reliance Brick Co., Des Moines, Iowa
Vincent, Harry, Vincent Clay Products Co., Fort Dodge, Iowa
Watkins, M. M., Brown Instrument Co., Chicago, Illinois
Wells, F. G., Maxwell, Iowa
Wheaton, J. J., Sheffield Brick & Tile Co., Sheffield, Iowa
Witel, John, Toledo Brick & Tile Co., Toledo, Iowa
Zook, Samuel I., Des Moines Clay Products Co., Des Moines, Iowa

CALENDAR OF CONVENTIONS[1]

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21–Aug. 16, 1924	Trip to Pacific Coast
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn., Inc.	Oct., 1924	
Am. Iron and Steel Institute	May 23, 1924	New York
Am. Zinc Institute, Inc.	Apr. 28–29, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	Apr. 25–26, 1924	Washington, D. C. Bureau of Standards
Chamber of Commerce of the United States	May 6–8, 1924	Cleveland, Ohio
Chemical Equipment Assn.	Sept., 1924	
Eastern Clay Products Assn.	Apr., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec. 9, 1924	New York (?)
Glass Container Assn. of America	Apr. 25, 1924	Atlantic City
Glazed and Fancy Paper Mfrs. Assn.	Week of Apr. 7, 1924	New York
Manufacturing Chemists Assn.	June, 1924	New York
Mirror Mfrs. Assn.	Mar., 1924	Pittsburgh
Natl. Assn. of Brass Mfrs.	Mar. 12–14, 1924	West Baden Springs, Ind.
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	Mar., 1924	Pittsburgh
Natl. Assn. of Mfrs. of the U. S. A.	May 19–21, 1924	New York
Natl. Assn. of Stove Mfrs.	May 14–15, 1924	New York, Hotel Astor

[1] Further information may be secured through the Chamber of Commerce of U. S., Washington, D. C.

Natl. Bottle Mfrs. Assn.	Last Week in Apr., 1924	Atlantic City
Natl. Glass Distributors Assn.	Dec., 1924	Pittsburgh
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Mfrs. Assn.	Dec., 1924	
Penna. Gas. Assn.	April, 1924	Atlantic City
Refractories Mfrs. Assn.	Mar. 19, 1924	St. Louis, Mo. (?)
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	May or June, 1924	
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh
Western Society of Engineers	June 4, 1924	Chicago

ERRATA

Bulletin of the American Ceramic Society, **3** [1], 39 (1924): Under the Biographical Sketch of Karl Turk, "Penn" System should read "Pemco" System.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Vol. 3 April, 1924 No. 4

EDITORIALS

A CERAMIC INSTITUTE

Certified testing of materials and products, and opportunity for determining the most economic methods and processes unbiased by competitive interests are the basic reasons for the increasing demand for a Ceramic Institute. Such an Institute would have to be supported directly by the ceramic manufacturers. It is a cold business proposal stripped of altruism.

The benefits would have to be proven in terms of dollars and cents but with appreciation of the value of looking ahead. A program of investigations that did not anticipate the future needs would be shortsighted and not worthwhile. The present needs must be cared for but to limit an Institute program to these would result in a fluttering of purpose and a temporizing in expediences. To be productive, to prove itself by a dollar and cents standard, a Ceramic Institute must be broad as well as sound in its conception and conduct.

Such an Institute should not overlap in purpose or program any of the existing investigational organizations which ceramic manufacturers are supporting and must continue to support through taxation. The waste which would result from duplication of laboratories and personnel as well as in activities must be avoided. The employment to the full of the existing agencies is sound economy of time, money and human effort.

There is now no non-commercial institution engaged in routine ceramic testing. There is no place where materials and problems can be submitted with surety of being investigated. The Federal and State departments want such an institution and the Ceramic Institute properly organized and equipped would fill this want.

There is now no central pooling agency for technical directing of investigational work. This results in duplication and entails the loss of concerted effort. For example it was proposed at one of the sessions of the White Wares Division of the AMERICAN CERAMIC SOCIETY to initiate an investigation of the sagger problem and of the standardization of feldspar. The U. S. Potters Association has undertaken these but limited only to their own members without the collaboration of the other ceramic groups which are equally concerned industrially and financially. The AMERICAN CERAMIC SOCIETY has not organized to raise funds and to prosecute investigations. It should and does concern itself, however, with finding ways and means of obtaining the fullest possible collaboration in investigations of direct interest to more than one group. This is the reason for its possible interest in a Ceramic Institute.

The success of the joint investigation of kiln fuel economies by the four Heavy Clay Associations shows the value of the several ceramic associations pooling their technical investigations through an institute.

The Mellon Institute, the Federal Bureaus and the Universities offer opportunities for much of this desired collaboration. The services they are rendering should not be duplicated. A more intimate contact of these agencies with the industries should be obtained. The Institute with which this editorial deals would manifold and make more intimate these contacts without in the least decreasing the control over the investigations undertaken and the reports rendered. This Ceramic Institute would provide means for the Universities making similar contacts through fellowships and participation in general investigation programs.

The trade associations should be engaged in technical research of their production problems and in standardization of their product. Promotional sales engineering requires technical research on materials and products, and competition necessitates the highest quality at the lowest cost. That these desiderata are appreciated by ceramic trade associations is shown by the investigations they already are financing in coöperation with the several laboratories and by the proposal by the Common Brick Association of founding a Ceramic Institute.

The Ceramic Institute could be a chartered organization with a directorate elected by the association members. It could employ a Technical Director for full time service and a small staff of part and full time routine laboratory assistants. The Institute would determine the available laboratory and personnel facilities and place with each laboratory the

investigation which it is best fitted to conduct. After placing the investigation, the contact between the financing group and the laboratories would be as direct as it could now possibly be, the Institute through its Technical Director acting in a consultant capacity.

The Ceramic Institute should coördinate its organization and work with that of the AMERICAN CERAMIC SOCIETY using the SOCIETY'S organization for collaborating in research, compilation of data, preparation of standards, investigation of methods, contacting with other investigational societies and institutions; and especially should the Institute employ the editorial, abstracting and bibliography service rendered by the SOCIETY.

The AMERICAN CERAMIC SOCIETY is devoted to promoting the technical welfare of the ceramic industries. It is organized especially for this limited service. In contrast, the trade associations are organized for the promotion of the trade interests of their firm members. It has been the realization of need of technical research in production problems that trade associations have engaged in coöperation with the Federal and institutional laboratories. The SOCIETY was not organized to undertake the financing of investigations. Its function has been to interest trade associations in undertaking technical research of their production problems and the purpose of this editorial is to show that the interested groups can go one step further and coördinate these investigations through a Ceramic Institute without loss of contact and proprietary rights and privileges. This Institute would thus serve a purpose for which no existing organization is qualified to undertake and which would not duplicate, conflict nor alter the present organizations and schemes of coöperation. It would serve as a coördinating agency in ceramic research, reduce duplication, secure collaboration of all groups interested in a given problem and effect economies from these and the several other items of wastage that come from lack of a coördinated program. And not the least important, it would command universal respect for the findings approved by the Ceramic Institute and provide a unit source of information and action.

The AMERICAN CERAMIC SOCIETY would fall short in its obligations to the ceramic industries if it failed to adapt itself to this new scheme of coördinated research.

HAS THE SOCIETY BENEFITED POTTERS?

A prominent pottery owner has expressed regrets that the SOCIETY is not of more benefit to the potters. This criticism, expressed in confidence and without the withdrawal of his corporation and personal membership, is taken as a friendly challenge which the SOCIETY meets frankly and fearlessly. If one, who for years has been and now is a loyal supporter

would question the value of the SOCIETY, surely those potters who have not affiliated and made use of the SOCIETY have no reason for investing in it.

If the benefit of the SOCIETY to potters is not evident, the cause is either that the potters have not been receptive and aware of the agencies through which information has been made available or the SOCIETY is not functioning correctly and making known its activities. We can hold no brief for either the "doubting potter," or the SOCIETY. As it is now constituted and operated, for our concern it gives effective service.

Surely there can be no questioning of the benefits which are possible from a collaboration of ceramists in the searching and recording of information. This is a coöperative research. It is an orderly acquisition of information, an exchanging of the bit which one has found for the total sum recorded by others. It is a coöperative abstracting and recording of the printed records from the world's literature. It is making available to all ceramic industries the things of common interest in each of them.

If there is any value in being informed, surely there is value in this broad coöperative exchanging of information. No one person could possibly accomplish what the members of the SOCIETY collectively are doing. No journal or institution of limited personnel and limited industrial contact could be as effective. No single industrial group working alone could be as broad and thorough. A SOCIETY of ceramists representing all of the ceramic industries is essential to the most effective and the most productive obtaining and proving of that knowledge by which and only by which progress is possible.

It is significant that following the example set by the AMERICAN CERAMIC SOCIETY similar societies have been organized in six other countries. It is significant also that the industries which have enjoyed the greatest progress have engaged most intimately in this same sort of collective searching for knowledge.

The rapid progress made in "potting" in America is creditable to no small extent to the fact that there has been a SOCIETY devoted exclusively and intensively to the finding and proving of scientific facts. This can be proved in specific cases and processes. Such lack of evidence of truth as there may be in this assertion lies in the fact that recorded information is of no value to any individual until it is adapted by him and applied. Differences in ability, and resourcefulness in finding and using facts is a measure of the difference in value to each participant of this organized collecting, abstracting, classifying and proving of specific facts.

There are those like Josiah Wedgewood, to whom it is natural to search for and apply knowledge. He demonstrated that, without school training, and without benefit of trade papers, and without the inspiration and help of organized collaboration of his fellows it is possible to make wonderful

progress. He sought and obtained information and assistance. Like Bell of the telephone, Wedgewood recognized the applicability of various bits of knowledge. It is the ability to sense facts and to make application that distinguishes those who have been the world's greatest inventors and industrialists. This ability will express itself in spite of such handicaps as lack of scientific collaboration.

There are those who obtain very little benefit from school training or from collective research with his fellows. They do not have the capacity to find, to recognize and to use information. But both those most proficient and those least adept in finding and using facts will profit from collaboration with his fellows. If the activities of the AMERICAN CERAMIC SOCIETY have benefited one potter more than another it must be due to the differences in their capacity to recognize and to apply information.

To be consistent in the denial of benefits from the activities of the SOCIETY, one must deny the benefits accruing from ceramic schools, and from the ceramic divisions of the federal bureaus, for which the SOCIETY was directly responsible. To deny these benefits is to deny that progress has been made in manufacturing and in maintenance of quality.

Several potters are participating with profit in the work of the 500 members of the Whiteware Division. They do not question the value to them of its present and potential service. The AMERICAN CERAMIC SOCIETY in general and the Whiteware Division in particular has been and continues to be in form of organization and in activities, very responsive to the most urging demands made on it.

PAPERS AND DISCUSSIONS

THE MEANING OF "KERAMOS" ONCE MORE

BY W. A. OLDFATHER

In the *Keramische Rundschau*, **31** [1–3], 1–2 (1923) (in large part a clear presentation by O. Rasser of present technical usage in Germany), 11–12; 21–2, under the caption "Was versteht man unter Keramik?" Herman Hecht has submitted the[1] "Report of the Committee on Definition of the Term 'Ceramics,' " to a detailed criticism in which he expresses dissent from most of the recommendations of that Committee. At the request of the Editor of this *Journal* I shall reconsider some aspects of the question, because in one very important detail our knowledge of the subject has progressed since the report was made in 1920. Upon the few technical points about processes of manufacture, and the suggestion[2] that a better comprehensive designation would be "Silicate Chemistry," I have, of course, no opinion to express.

Dr. Hecht raises objection to the contention[3] that an established usage offers a measure of justification for the extension of the original meaning of a word, and asks (p. 12), "where and when has the technical world united clay products and glassware under the single designation 'Ceramics?' " (Cf. p. 21.) The answer is United States for some years past, and the substantial evidence for that statement is given on pp. 526–7 of the "Report;" to which we may now also add the twenty countries represented at the Fourth International Conference of Chemistry held at Cambridge, England, June 17–20, 1923.[4] Indeed, one is tempted to go even further, and on the strength of the argument from "the range of material which one finds presented to their readers by the American publications in this field,"[5] to suggest that even in Germany itself, where the need for such a comprehensive designation has brought forth the suggestion "Stone and Earth Products" (*Steine und Erden*), there seems already to be developing a use for the word *keramik* and *keramische* which closely approximates what was until recently the characteristically American one. The *Keramische Rundschau* itself, as a mere glance at its contents will show, contains articles, news, reports, and advertisements of glass manufacture (generally indeed under a separate heading from "Keramik" and "Email") in full measure, obviously as a part of its special field. Not only that, but its full official title confirms this preliminary inference:

[1] *Jour. Amer. Ceram. Soc.*, **3** [7], 526–42 (1920).

[2] *Keram. Rund.*, p. 22.

[3] "Report," p. 542.

[4] (See *Compte Rendu Analytique de la Quatrième Conférence Internationale de la Chimie*, Paris, **1923**, pp. 9, 10, 12.)

[5] "Report," p. 527.

"Keramische Rundschau. Fachzeitschrift für die Porzellan-, Steinzeug-Steingut-, Töpfer-, Glas-, und Email- Industrie." It would seem almost naïve to raise the question, "Where is 'Ceramics' used to include the glass industry?" in discussing a report the very second paragraph of which gives a detailed answer, and in the pages of a journal whose very title is an illustration of the tendency in point.

An important phase of the argument from Greek usage was the contention "that *keramos* and derived forms were not clearly felt by the Greeks to designate the material *per se* (as we speak of 'earthenware')." This was supported by a series of citations from Homer to St. Chrysostom, in which the designations golden, silver, bronze, marble, stone and lead were applied to the word and its derivatives.[1] Dr. Hecht[2] advances now the interesting view that the Greek potters may have called some wares gold, bronze, or silver *keramos* because of the particular color of the glaze. The only fact adduced in support is the occasional use of tiny patches of gilt on a few late vases, but even here there exists nothing that by any stretch even of fancy could be called as a whole "gold keramos," whereas there is no trace in literature or monuments of any silver or bronze *keramos* of the kind postulated, to say nothing of marble, stone, or lead *keramos* (or *keramis*). It is perfectly clear that in the passages cited we do not have to do with earthenware of any kind, but actual metal or stone in the shape of articles that were ordinarily made of earthenware. For example, an earthenware jar with a purely hypothetical bronze glaze, to justify Homer in speaking of a "bronze *keramos*," would have been a very flimsy thing in which to keep the redoubtable god of battles, Ares (Mars), for thirteen months a prisoner; and could any one fancy that the notoriously luxurious and extravagant Cleopatra used only earthenware with an again purely hypothetical gold and silver glaze, instead of actual gold and silver plate, as did not only all ancient princes from Homer's time onwards, but even thousands of well-to-do private citizens?

But after all these are minor points. Dr. Hecht lays most stress on the assertion that *keramos*, whatever its etymology, meant normally "clay" in Greek (p. 2, 11–12, 21), calling attention to the fact that I did not absolutely deny the possibility of this meaning,[2] although I had a shrewd suspicion that it was no more justified by usage than by etymology.[3] It

[1] "Report," pp. 539–40.

[2] *Keram. Rund.*, p. 21.

[3] "Report," p. 537: "*keramos*, a general term designating the product (and perhaps also, although apparently later, if at all), the material of the potter's art." *Op. cit.*, p. 539, n.l.: (After rejecting the best examples given by the lexicons for this meaning of the word) "I do not claim that *keramos* never means 'clay,' for, of course, I have not examined all the thousands of instances of the occurrence of this word, and those that are derived from it, but the cases cited by the lexicons for this meaning are not conclusive, and, in any event, that can scarcely have been the primary meaning."—Anyone

is on this point that the general question has advanced somewhat since the "Report" was published. During 1920 and 1921 A. F. Pauli of the University of Illinois worked upon the lexicography of *keramos* and its derivatives, in part under my general supervision, and presented his results in a dissertation in June, 1921 entitled, "Studies in the Vocabulary of Ancient Greek Ceramics: Keramos and its Derivatives." This dissertation, in part recast so as to make its results more generally understandable, will be published soon, it is hoped, and there the proof will be presented in detail for the contention that *keramos* never means "clay," but only "the baked material of earthenware," "earthenware" itself, some special variety of "earthenware," or some other material in the shape of an article that was ordinarily made of "earthenware." The testimony of the lexicons, accordingly, which in Greek is generally incomplete and antiquated, in this case completely collapses before the unanimous verdict of the etymologists, whose work in contrast with that of the lexicographers is scientific, thorough, and up-to-date, and before an exhaustive examination of all the available evidence drawn from the greatest variety of sources. *Keramos* did not, therefore, either originally, or by derived and extended meaning, designate to the Greeks "clay," but rather primarily "earthenware," or, precisely what its etymology requires, "the burnt stuff,"[1] and therefore an adjective derived from it may, when a widespread technical usage has already developed independently, with propriety be applied to any product "in whose manufacture a change of physical and chemical properties under the influence of high temperatures is required"[2] in which, in other words, "burning" is the characteristic feature of production.

University of Illinois
Urbana, Illinois

experienced in lexicographical studies will recognize that in a collection of several score passages containing a term which might be translated by such closely related words as "clay" and "earthenware," there will be a few in which either meaning might make sense. The semantic test is whether there are any passages where a certain meaning is *demanded* in order to make sense. Thus, if in the majority of a large number of sentences *keramos must* mean "earthenware," and with that meaning makes perfectly good sense in all the other instances, while it *never must* mean "clay" but only occasionally *might* mean "clay," where, however, the meaning "earthenware" is just as good, then it is clear that "earthenware" is the only demonstrable meaning for the word.

[1] "Report," p. 539.

[2] "*Ibid.*," p. 540.

FUEL OIL BURNING TO OBTAIN THE HIGHEST TEMPERATURE COMBINED WITH UNIFORM HEAT DISTRIBUTION

By G. Ross

Variants The many systems of oil burners which exist on the market today make it impossible for Engineers to investigate them individually, and determine which one is most suited to his purpose. In general, burners can be classified as high or low pressure burners, or as burners with a greater or less atomizing effect.

The character of oil used is of first importance, and the results obtained will be widely different between heavy oil, light oil, and all the gradations between these two extremes. The temperature at which oil is fed to the burner is also of great importance.

Objective It is necessary to combine the above factors in such a way as to produce:

A concentrated long flame
A concentrated short flame
A voluminous long flame
A voluminous short flame

These different flames are used by direct or indirect firing for obtaining

(*a*) A low temperature (500°C)
(*b*) A middle temperature (1000–1200°C)
(*c*) A high temperature (1400–1500°C)

When the desired result is to obtain temperatures up to 1200 degrees by means of direct firing, the matter becomes relatively easy. The object of this discussion is to cover only the most difficult one of the combinations specified, *viz:* to obtain a temperature from 1400° to 1500° and at the same time a uniform distribution of the heat in all parts of large furnaces which are to be heated indirectly.

Discussion In the case of indirect firing, great resistance is interposed by fire-brick walls or by the walls of a retort to the passage of sufficient calories to secure the high temperature mentioned. For ordinary purposes the best burners are those which give the greatest atomizing of the oil, and the best mixture between oil and air. When this result is secured, the combustion between the two occurs close to the mouth of the burner to secure a long flame with an even distribution of the heat. Such a burner is not suitable for a uniform distribution of heat in a large furnace, using indirect firing and requiring a long flame. Too many calories are developed at the mouth of the burner, resulting in a concentration of heat at that point, and in an impoverishment of the flame beyond that point; which makes it impossible to secure the desired high temperature over the remainder of the furnace. Complete combustion is secured by this atomizing and perfect mixing with air,

but the stream combustion product, has but little more heating value than the gases ordinarily described as waste heat, and with the temperature which resulted from the combustion which just occurred. This temperature is not sufficient to reach 1400° by indirect firing.

One of the most important distinctions between coal firing and firing with oil or cleaned gases, is that in the first case the gases are charged with a multiplicity of particles of ash and unburnt coal. In the second case there are a very few particles of ash or unburnt carbon and the resulting waste heat gases are clear and transparent. The condition of a small number of particles is only true within a short distance of the burner, and the gases at a farther distance have no unburnt particles which can act as a medium for the transportation of the calories. Irrespective of the amount of combustible burnt, the lack of these particles prevents points in the furnace remote from the burners, from reaching the temperature desired. To reach such a temperature some medium is needed for the transportation of the calories from the combustion zone to all the points at which this temperature must be secured.

This is demonstrated by the following experiment:

In a furnace heated by producer gas, from one end, and after reaching the desired temperature throughout the furnace, the gas was closed off, and coke oven gas which had been well cleaned of all mechanically entrained particles, was admitted. The temperature of combustion of this gas was higher than that produced by the producer gas. In spite of this, pyrometric observations taken against the outside and inside of a retort at a distance of one meter from the point where the coke oven gas was admitted, gave the following extraordinary results: As soon as the coke oven gas began to replace the producer gas, the outside temperature of the retort began to fall. The inside temperature remained stationary for some time, and later assumed the same temperature as the outside. This experiment was repeated several times, and it was later found that an excess of coke oven gas had been admitted, and that if this excess were reduced to a minimum, that a certain amount of unburnt carbon resulted, providing a radiant medium, and bringing the temperature back to the same point which was reached by the producer gas. The temperatures involved are approximately 1400° on the outside of the retort, which maintained 1280°C on the inside of the retort. The thickness of the retort wall was 30 mm.

From the above it is apparent that although high atomization and complete air mixing produce highest temperature near the orifice of an oil burner, this combination will not secure the result of uniformly distributing the heat over a large furnace, nor secure the necessary temperature on the inside of a retort. The use of a minimum excess of oil ameliorates to some extent the unfavorable conditions described above. It burns

by slow combustion over the entire distance from the burner to the outlets of the furnace, producing a certain amount of free carbon particles which transport some of the heat from the combustion zone to the more distant parts of the furnace.

This expedient will serve to produce the desired temperature with the ordinary type of burner, but even then the distribution of heat is not uniform over the furnace, being much higher near the burner, and much lower near the waste gas outlets.

To secure this latter result it is necessary that the burner does not atomize the oil, but rather throw it into the furnace in particles comparatively small, but still of sufficient size so that complete combustion does not take place until the entire length of the furnace has been passed. This system of combustion is only possible when the temperature of the furnace is very high (about 1400°), as otherwise rapid and complete combustion would not be secured. Theoretically, the mixture of air and unburnt oil must continue until the most remote parts of fire-brick wall or retorts are reached, in order that these latter points will have a continuous influx of calories. To have the heat distribution uniform and at the correct temperature, the burner must supply sufficient perfect combustion near its orifice and produce the highest temperature desired, and there must be a sufficient excess of unburnt oil and air to transport this temperature to the farthest points of the furnace. These unburnt particles of oil and air, must impinge on the farthest retort and burn at that point to complete combustion. These particles must still be fine enough to assure complete gasification and rapid burning.

Conditions will be greatly dependent on the quality of the oil, and its temperature as it enters the burner. If the oil is too light, it will be too easily volatilized and will be decomposed too soon in high temperatured furnaces before being able to complete the trajectory to the end of the furnace. If the oil is too cold, it will not permit a rapid combustion, nor will the particles produced by the burner be of sufficiently fine size; while at the same time it will prevent the obtaining of the high initial temperature desired near the mouth of the burner.

To secure the conditions desired as outlined, the highest temperature must be developed near the burner mouth, and the stream of unburnt and waste products must carry in suspension sufficient particles of oil and air, so that their gradual combustion will produce heat and carbon particles over the entire distance until each part of the furnace has been reached. The specific gravity of the oil is limited on the one hand by the fact that higher gravity oils will volatilize too quickly; and on the other hand that the heavier oils will form particles so large that they will not burn quickly enough. The correct oil will form particles which will be large enough to last until the remote points of the furnace are reached,

but which at that point will be entirely consumed. These particles, at the same time, act as transmission agents for the excess calories which are produced near the burner and carry them to the more remote points.

It is evident that these heavy particles in the stream of oil and air have a natural tendency to drop to the bottom of the furnace, leaving the stream too poor in hydrocarbons as the farthest end of the furnace is reached. To overcome this factor, it is necessary to give the oil and air a strong mechanical impulse at the burner, which will insure the travel of these particles to the farthest points of the furnace before allowing them to drop.

An important distinction between oil and gas firing is that the number of calories produced from oil or other high calory fuels in a given unit of time is much larger than that produced by producer gas. This necessitates careful designing near the orifice of the burner to provide the correct combustion space that may be required by these different fuels.

The object of this article is to present some phases of this important question to the attention of the different engineers and metallurgists who have experimented along these lines, and to invite their discussion.

METALLURGICAL ENGINEER
GENERAL MANAGER, SALTILLO, MEXICO

REFRACTORIES QUESTION BOX

E. E. AYARS, EDITOR

I. What effect does 2% or more of titanium oxide have on fire-clay refractories?

Discussion It lowers the fusion point slightly. A value of $^1/_2$ cone per 1 % has been suggested when the clay has a composition similar to that of kaolinite. However, most fire clays contain 2% of titania, the amount present usually varying with their alumina content. This is a fortunate condition as the more aluminous clays are better able to carry the additional burden. Generally speaking the better clays high in silica carry about 1%, the "normal" clays about 2%, and the highly aluminous clays 3%. It is quite probable that the fluxing power of titania is less than $^1/_2$ cone per 1% when present in the small amounts found in fire clay—a rough value of $^1/_4$ cone per 1% might be more appropriate. It is difficult to lay down an iron clad rule because of the different forms in which it may be present and the other characteristics of the clay.—RAYMOND M. HOWE, Kier Fire Brick Co., Pittsburgh, Pa.

The following discussion is taken from "British Clays, Shales and Sands."—A. B. SEARLE.

Titanium compounds occur more frequently in clays than is commonly supposed, though only in small quantities (under 2% TiO_2) and in the ordi-

nary methods of analysis it is included in the figures for alumina. Titanium compounds occur chiefly as rutile (TiO_2), ilmenite ($TiFeO_3$) and titanite ($CaTiO_5$) and act as somewhat powerful fluxes; hence clays which are required to be highly refractory should not contain more than 2%. Several investigators have independently examined the effects of titanium oxide on china clay and on artificial mixtures of alumina and silica. Their results show that within the limits in which this substance usually occurs in clays, the reduction in refractoriness is less than 40°C and is therefore negligible if less than 2% of titanium oxide is present. Ten per cent of this oxide lowers the softening point of kaolin about 100°C, but on fire clays richer in silica it has less effect.

II. What is the effect of 2% or more of titanium oxide in refractories, upon their resistance to alkaline fluxes?

Discussion

The tests made by the writer were parts of a general study of the resistance of refractories to alkaline fluxes. They were made by preparing a glass of arbitrary but constant composition (using sodium carbonate and sand only) so selected that it could be melted to a thin fluid at heats obtainable in the laboratory, and consequently more alkaline than commercial glasses. Test pieces of the refractories were made into roughly cubic form. A quantity of the glass mentioned above, bearing a definite relation by weight to the test piece of refractory, was melted in a platinum crucible. The test piece was dropped into the melted glass, and allowed to remain there, covered, for one-half hour. The mass was then poured out, the glass adhering to the test piece was dissolved away, and the cleaned piece ignited and weighed. The loss in weight as compared with the original condition was taken as an index of the resistance of the refractory.

In these tests the action of the flux was confined to the surfaces of the test pieces. There was no indication that the flux penetrated the entire mass and selectively removed the less refractory components. It was recognized that this highly accelerated test might lead to faulty conclusions in deciding as to the best ratio of silica to alumina in the refractory but it was thought that by adding increased amounts of titanium oxide to a known mixture of clays that some idea of its effect might be gained. In this way the following results were obtained:

Loss from test piece made from clays containing 2–3% TiO_2	14%
Loss after adding to same mixture 10% TiO_2	27
Loss after adding to same mixture 50% TiO_2	50

Although these tests should be repeated and greatly extended to reach a right judgment as to the effect of titanium oxide, they are sufficient to create in the mind of the writer the impression that this material decreases rather than increases the resistance of refractories toward alkaline fluxes.

It may be added that similar tests with zirconia led to similar conclusions.—J. D. CARTER, Phila. Quartz Company, Philadelphia, Pa.

(NOTE—Further discussion of the above question is solicited.)

III. What is the best type of brick to use in the side walls of air furnaces?

Discussion In contributing to a discussion on the character of refractories required for service in air furnace side walls little can be added to what the writer has already said elsewhere from time to time.[1]

A very casual inspection of an air furnace at the end of a campaign discloses the fact that the greatest destruction has taken place at the slag line, until the wall has become so thin that the better preserved brick, higher up, must be removed and the lining rebuilt to prevent the wall tipping over.

Since the walls near the roof are hotter than at the slag line, it is evident that brick as now made resist temperature better than chemical action. Spalling in side walls, though not unknown, is rather unusual.

The point of attack for the side wall problem is thus to produce a chemically resistant brick. Chemical resistance, for a given material, may be increased by decreasing slag penetration by making a denser brick. Fine grinding, hard pressing, high firing temperature, and a correct grading of fine and coarse material are means in this direction.

Theoretically, it is possible to imagine a refractory less likely to combine chemically with the slag constituents. The problem would then become one of making an artificial mineral to order rather than of using natural clays.

In the malleable furnace the chemical problem is complicated by the changes in composition of a slag during melting. The first material formed is nearly pure molten Fe_3O_4. This becomes reduced promptly to FeO, and combines with SiO_2 from the brick, sand bottom, and the oxidation of Si in the metal to a final composition approximating

FeO	29.0
Fe_2O_3	1.0
MnO	5.0
SiO_2	51.0
Al_2O_3	14.0
	100.0

We have thus at various stages of the same heat slags ranging from the most basic to the most acid of open hearth practice. Fortunately, during the larger part of a heat the slag remains of the last given analysis. It

[1] Schwartz and Gorton, "The Requirements of Fire Brick Suited to Malleable Practice," *Jour. Amer. Ceram. Soc.*, **6** [10], 1094 (1923).

may be well, however, that most of the actual damage is done by the slag while basic. The entire problem would seem to possess great interest for the ceramist.—H. A. SCHWARTZ, Nat. Malleable Castings Company, Cleveland, Ohio.

Fire brick to be used in the side walls of air furnaces in the malleable iron industry must withstand high temperatures, sudden changes of temperature, and the chemical and physical action of a basic slag.

Some companies line their furnaces with coarse grained open textured brick, while others use a very fine, hard burned brick. It is probable that the best type for general use in this connection is a "happy medium" between these two extremes. Brick of open texture will naturally absorb considerable slag and this may eventually cause failure, but usually such brick, if of the proper chemical composition, glaze over and absorb very little, if any, additional slag. Hard brick will not readily absorb slag but are sensitive to thermal shock.

Siliceous clay brick fail quickly in air furnaces from spalling and from the chemical action of the slag.

The type of brick that has given exceptionally good results in the sidewalls of air furnaces has a chemical composition approximating that of kaolinite, has a fusion point of cone 32, low slag absorption, porosity of about 20%, medium grind and a light burn.—C. E. BALES, Louisville Fire Brick Works, Louisville, Ky.

IV. Does the use of powdered coal decrease the life of fire brick in malleable iron furnaces?

When powdered coal was first introduced for melting in malleable iron furnaces excellent results were obtained from the refractory lining, but later, some foundries experienced considerable trouble from slag action and flame erosion. At present, malleable iron experts are of the opinion that the brick give the same service in powdered coal fired furnaces as they do in hand-fired furnaces of the same capacity.[1]—C. E. BALES, Louisville Fire Brick Works.

In discussing the requirements of refractories for any particular service one must not lose sight of the fact that each furnace installation is a distinct problem in itself. The matter of combustion chamber design enters into the question of hand firing, powdered coal or oil burning and the service of the refractories in various parts of the furnace will be more or less satisfactory, depending on the amount of furnace experience built into the furnace.

Without doubt the use of powdered coal enables the melter to push the furnace much faster than is possible with hand firing, and the same

[1] Schurecht and Douda, "The Behaviour of Fire Brick in Malleable Iron Furnace Bungs," *Jour. Amer. Ceram. Soc.*, **6** [12], 1232 (1923).

thing applies to the use of oil. With proper combustion chamber design the service of side wall and bung brick should be as good with powdered fuel as with solid.

The same refractory will not always serve in either case and the selection of the brick to use must be made from a practical test.—ED.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

A conception of the real interest of the industries in general in what the Ceramic Society is doing is reflected in the space given to our Atlantic City Meeting by the various trade journals. The March issue of the *Ceramic Industry* uses eighteen pages and nineteen cuts, a very well-written article covering in detail the general session as well as the sessions of each of the seven industrial divisions. They say that this meeting was the "biggest and best Convention that this august body has every had." The *Chemical & Metallurgical Engineering* in their Feb. 11th and Feb. 18th issues use nine pages and nine illustrations, reporting especially in detail the general session and the sessions of the Refractories, Enamel and the Glass Divisions. The *Glass Industry* devotes four and one-half pages and uses twelve illustrations in reporting our meeting, and are especially to be commended for their excellent account of Glass Division Meetings. The March number of the *Brick & Clay Record* covers very completely the Convention activities of the Heavy Clay Products, the Refractories, the White Ware and the Terra Cotta Divisions, using six pages and three cuts; and the *Enamelist* in two pages reports the Enamel Division Meeting. The *Clay Worker*, the *Glass Budget*, the *Glass Worker*, the *China, Glass and Lamps* and the *Pottery Glass and Brass Salesman* were liberal in the space given to the report of this Convention.

A comment of *Chemical & Metallurgical Engineering* in reporting our Convention is especially to the point, for it emphasizes an admirable quality typical of our Society, a quality that is fundamental in our success. The comment is as follows:

"From the climatic point of view, Monday, February 4th was perfect and the fact that nearly three hundred resisted the natural temptation to join the throng on the board walk speaks well for the excellence of the program and is an indication of the genuine interest in the activities of the industry that permeates this organization."

As a matter of fact, practically every member at any one of our meetings finds that if he misses a single hour, he has missed something of real definite value in his work. Even more attractive than the opportunity to bask in the sunshine of a Spring day in February and to fill our lungs with the unbreathed air, fresh from over the Atlantic Ocean was the opportunity to revel in the discussion of our every-day problems and to drink to our full the inspiration from papers by resourceful fellow workers who had put in black and white some of the things we have long wanted to know.

Inspiring research work along the right lines is an important work. This is being handled as effectively by the service committees as can be expected under the conditions. The immediate and most urgent task of the Board is to show those who are being benefited just how they can make the work of these committees more effective. Our field of usefulness and the expectations of the service have increased faster than our income will allow. There are many things we should do which we cannot without a larger income. The Society is solvent and is now operating within its income but our activities are far from what they should be.

Our funds come from three sources—dues from the members, both personal and corporation; payments we receive from our advertisements in the *Journal;* and the receipts from the sale of our publications. The Board of Trustees considered a long time before increasing the dues of the members from $7.50 to the constitutional limit of $10.00.

It would be better to have every corporation an interested member at $25.00 a year rather than a fewer number at a larger fee. The larger number of members has a double result; gives us more capital to work with and adds another worker. Both of these increase our ability to serve. Any efforts we make to increase our list of cor-

poration members will assist in making the industries as a whole realize that our activities have a real value from the dollar standpoint.

In just the same way, when we obtain a new advertiser, we are doing him a distinct service, for our *Journal* goes to a selected list of men to whom he can for a very small sum of money tell his story each month and reach them when they are in a receptive mood. Our members and the readers of the *Journal* are the men who make the final decision regarding materials and equipment to be used.

You, who are reading this page, are the fellows who can make our financial problems easy. You know a man in an organization already a corporation member who should be a personal member. You know a corporation—perhaps it is your own—that is benefiting from the work of our Society and yet is not a corporation member. Every day you are buying materials from companies not represented on our advertising pages. Just think what it would mean to the Society if everyone who reads this page would write today to one man who should be a personal member, to one corporation that should be a member, and to one supplier of materials who should be an advertiser. Here are the fruits of work done in the securing of new members last month.

MEMBERSHIP WORKER'S RECORD

	Personal		Personal
Alfred O. Ashman	1	J. W. Mellor	1
A. U. Cote	2	R. C. Rahn	1
F. W. Donahoe	2	Frank S. Roberts	2
R. F. Ferguson	2	W. F. Rochow	1
Howells Fretchett	1	John Sawyer	2
C. B. Harrop	1	Alexander Silverman	1
Charles J. Hudson	1	Office	9
Eugene J. Hysell	1		—
R. D. Landrum	1	Total	29

The Roster Continues to Rise

	Personal	Corporation	Totals
Net Record Jan. 15	1990	296	2286
Acquisition up to Feb. 15	41	8	49
Acquisition up to Mar. 14	29	0	29
Gross Totals March 14	2060	304	2364
Withdrawals	68	5	73
Net Roster Mar. 14	1992	299	2291

NEW MEMBERS RECEIVED FROM FEBRUARY 15 TO MARCH 15

PERSONAL

Andrews, Andrew Irving, Graduate Student, U. S. Bureau of Mines, Lord Hall, Ohio State University, Columbus, Ohio.

Aregood, Joseph M., Foreman Molding Dep't, Vitrefrax Company, 1317 E. 61st St., Los Angeles, California.

Buit, Theodore, Enameling Dep't, Alaska Refrigerator Co., 36 Rathburn St., Muskegon, Mich.

Carter, C. C., Sup't Buckeye Tile Co., Chillicothe, Ohio.

Cochran, A. D., Salesman Clay Working Machinery, Bonnot Co., Careton, Ohio.

Devereux, Percy Stewart, Works Mgr., The British Abrasive Wheel Co., Ltd., Tinsley, Sheffield, England.

Duggan, Adele Ida, Occupational Therapist, U. S. Veteran's Hospital No. 16, Oteen, N. Carolina.

Helmer, Charles M., General Mgr. Hall and Sons, Inc., 69 Tonawand St., Buffalo, New York.

Holland, Henry Donald, Engineer Crooksville Shale Brick Co., Crooksville, Ontario.

Howe, W. L., Research Assistant, Norton Co., 16 Greendale Ave., Worcester, Mass.

Kane, Richard S., Draftsman, C. B. Harrop, 1591 N. Fourth St., Columbus, Ohio.

Lewis, Nathan E., Engineer of Babcock & Wilcox Co., 85 Liberty St., New York City.

Mauser, H. W., Jr., Engineer, Royal Delftware Manufactory, 20 Julianalaan, Delft, Holland.

McLaughlin, N. H., Sec'y Alsey Brick and Tile Co., Alsey, Illinois.

Myers, E. F., President, The Ironton Fire Brick Co., Ironton, Ohio.

Miller, William B., Ceramic Section of the Research Dept., N. J. Zinc Co., 462 Lafayette Ave., Palmerton, Pa.

New, Ryland H., President, The Hamilton & Toronto Sewer Pipe Co., Ltd., Hamilton, Ontario, Canada.

Poxon, G. J., Pottery Manufacturer, 2300 E. 52nd St., Los Angeles, Calif.

Remsen, John N., Assistant Gen. Sales Mgr., United Alloy Steel Corp., Canton, Ohio.

Robertson, Foster, Junior Fellow, Mellon Institute, Pittsburgh, Pa.

Rodgers, Henry P., Partner, Rodgers and Reitz, 15 E. Fayette St., Baltimore, Md.

Roefer, Chas. M., Ceramist, Federal Clay Products, Mineral City, Ohio.

Roy, William, Sup't, Crooksville Shale Brick Co., Crooksville, Ont., Canada.

Schwall, Harry Edwin, Aid to Sup't, Southern Potteries, Inc., 605 Ohio Ave. Erwin, Tenn.

Sheppard, F. W., Harbison-Walker Refractories Co., Brown Marx Bldg., Birmingham, Alabama.

Spence, Hugh S., Mining Engineer, Mines Branch, Dep't. of Mines, Ottawa, Ontario, Canada.

Thorman, Floyd M., Laboratory Supervisor, United States Gypsum Co., Oakfield, New York.

West, Charles, President, Glass Manufacturing, Grapeville, Pa.

Willmer, Heinrich, Heat Efficiency Expert, Cologne Nippes, Germany.

NEW ENGLAND SECTION MEETING

The first meeting of the year for the New England Section of the AMERICAN CERAMIC SOCIETY was held at the Boston City Club on March 8th with the following members and friends present.

J. R. Fuller, Hygrade Lamp Company, Salem, Mass.
R. Booth, General Electric Co., Lynn, Mass.
R. P. Newhall, General Electric Co., Lynn, Mass.
H. L. Young, Bristol Company, Old So. Bldg., Boston, Mass.
J. F. Indordohnen, Bristol Company, Old So. Bldg., Boston, Mass.
W. L. Howe, Norton Company, Worcester, Mass.
G. L. Nordin, Superior Corundum Wheel Co., Waltham, Mass.

Wm. Pettigrew, Norton Company, Worcester Mass.
Glenn D. Williams, Norton Company, Worcester, Mass.
Arthur T. Malm, Norton Company, Worcester, Mass.
Charles J. Hudson, Norton Company, Worcester, Mass.
Gustaf A. Hiding, Norton Company, Worcester, Mass.
H. L. Watson, General Electric Co, Lynn, Mass.
O. C. DuSossoit, Taylor Instrument Co., Boston, Mass.
C. B. Tilton, Cortland Grinding Wheel Co., Chester, Mass.
Leon B. Bassett, Baxter D. Whitney & Son, Winchendon, Mass.
Elliot D. May, Baxter D. Whitney & Son, Winchendon, Mass.
Prof. Gordon B. Wilkes, Mass. Inst. of Tech., Cambridge, Mass.
Prof. Charles L. Norton, Mass. Inst. of Tech., Cambridge, Mass.
Dr. S. W. Stratton, Mass. Inst. of Tech., Cambridge, Mass.
R. Richardson, Mass. Inst. of Tech., Cambridge, Mass.
Irving B. Loud, Norton Company, Worcester, Mass.
Edwin G. Chaffin, Norton Company, Worcester, Mass.
George Henderson, Dorchester Pottery Wks., Boston, Mass.
R. M. Farnsworth, Lancaster, Mass.
M. F. Cunningham, Waltham Grinding Wheel Co., Waltham, Mass.
C. H. Lawson, Waltham Grinding Wheel Co., Waltham, Mass.
Albert A. Klein, Norton Company, Worcester, Mass.
Arthur E. Baggs, Marblehead Potteries, Marblehead, Mass.

At the election of officers it was voted that the same members serve again for 1924.

The speakers for the evening were, Dr. S. W. Stratton and Prof. Charles L. Norton, and Prof. Gordon B. Wilkes of the Massachusetts Institute of Technology.

They spoke on "The Proposed Development of Ceramics" and "Ceramic Research at the Technology."

A general discussion followed.

Tentative plans were suggested on forming a committee representative of the Ceramic Industries of New England to meet with Prof. Norton and his associates to formulate means whereby the Technology could better coöperate with the New England Ceramic Industries and help them with their problems.

The suggestions met with a great deal of enthusiasm and further work will be done along this line.

At the close of the discussion a rising vote of thanks was extended to Dr. Stratton, Prof. Norton and Prof. Wilkes and the meeting adjourned.

C. H. LAWSON, *Secretary-Treasurer*

FIRST CERAMIC MEETING[1]

Southern California Section of American Ceramic Society Discusses Future of Industry

A representative gathering of the heads of many important clayworking, refractories and other ceramic industries of Los Angeles and vicinity met at the Hotel Clark during the week, the occasion being the first regular meeting of the newly organized Southern California section of the AMERICAN CERAMIC SOCIETY, a national organization devoted to the advancement of the ceramic industry.

[1] *Los Angeles Sunday Times*, Mar. 2, 1924.

The officers of the local section are: A. Malinovsky, president; G. Ray Boggs, vice-president; Thomas S. Curtis, secretary-treasurer. Its membership is made up of the technical and executive heads of departments of practically every important ceramic manufacturing concern in the Southwest.

Interspersed between the various discussions of economic and technical interest, were musical numbers rendered by the young daughter of the president, Miss Olga Malinovsky, pianist, with violin by Master Charles Malinovsky. B. C. Berg, of the Schurs Oil Burner Company, sang.

Among the most welcome speakers of the evening was Prof. Hewitt Wilson, head of the department of engineering of the University of Washington. After showing the gathering that Seattle can boast and boast quite as enthusiastically as Los Angeles, Prof. Wilson gave an intensely interesting account of the work at the University, which work has had the collaboration of the United States Bureau of Mines through the Northwest Experiment Station. The first, and probably the most important work accomplished to date, has been a thorough survey of available raw materials, of which there appears to be an inexhaustible supply and a very considerable variety. It is Wilson's opinion, founded on this investigation, that the Northwest will some day be as independent from the ceramic standpoint as is Los Angeles, although much development work and a huge investment must needs be made before that section can hope to approach the importance of the Southwest in this big industry.

An intimation of the value of the American Ceramic Society in its relation to the economic development of the high temperature industries of the Southwest, was manifest in an informal talk by Thomas S. Curtis, president of the Vitrefrax Company of Los Angeles. This Company, a little more than three years ago, started the manufacture of super-refractories in a small plant in the Vernon district, specializing in the most difficult problems of the industry. From that small beginning, the Vitrefrax Company has grown to hold an unparalleled place in the refractories field, with an investment of nearly three-quarters of a million dollars in a modern steel and concrete plant, conceded by eastern visitors to be the finest and most unique refractories institution in the world. The business is nation-wide, approximately 70% of the product being shipped to eastern steel mills, copper refineries and electric furnace plants.

An appeal by Curtis, to the members of the fire-brick industry present brought to light a curious misapplication of technical data, as applied to the sales of fire brick. It appears that for many years it has been the custom to describe a fire-brick as being able to "stand so many degrees of temperature." The salesman having a high grade brick, refers to his brick as being able to stand 3200°F, for instance. This is commonly accepted as the melting point of the brick, and leads one to believe that the brick is satisfactory for service up to that point.

Mr. Curtis brought out the point that this is misleading unscientific and occasionally dangerous, for the reason that a softening takes place in all firebrick in some cases a thousand degrees below the actual melting point. It is the softening or deformation point that determines the suitability of the brick for service in specific cases. His plea was for all fire-brick makers to get together and agree to a specification or description of the characteristics of a fire brick that would give the customer and especially the engineer an inkling of the adaptability of the brick in his own problems.

To accomplish this, a new set of standards would have to be used. The melting point could be ignored altogether, and the temperature at which warping occurs, under a known load and shear stress, would be used as the indicator. The practical value of this suggestion has been recognized by customers of the Vitrefrax company all over the country, the appeal being unique in that it serves to give the customer an idea of the practical or utilitarian value of the brick in service.

The discussion which resulted from this suggestion was right to the point, and it showed the intense interest of a great majority of members who were not firebrick manufacturers but fire-brick users.

Other speakers on the program were Samuel Geijsbeek, who helped to organize the first section of the AMERICAN CERAMIC SOCIETY many years ago in the East; Mr. Steinhoff, of the *Brick and Clay Record*, and *Ceramic Industry*, two leading journals of the industry; Mr. Weber, of the Russell tunnel kiln organization of St. Louis; and Mr. Jackson, of the Empire China Company of Burbank. Mr. Jackson spoke on the availability and suitability of white burning clays and other ingredients of the raw mix in white chinaware.

Plans for the summer meeting of the SOCIETY to be held in Los Angeles were discussed by the presiding chairman, F. B. Ortman, of Tropico Potteries, Inc. A program has been arranged for the visiting members from the East, and it is estimated that more than one hundred visitors with their wives will come to Los Angeles on this occasion. Many plant visits have been planned, and it is believed that this influx of the heads of important ceramic plants of the eastern section may serve to stimulate further the development of our already full-fledged ceramic industry here in the Southwest.

ST. LOUIS LOCAL SECTION MEETING[1]

On March 18, 1924 the St. Louis Local Section of the AMERICAN CERAMIC SOCIETY held their quarterly meeting at the American Annex Hotel. "Oxygen—the Wonder Worker" was the title of an interesting motion picture illustrating how liquid air is made and why oxygen can be extracted from the air; how acetylene is made, and how gases are used by modern industry to effect the economies of oxyacetylene welding and cutting. This picture was produced by the United States Bureau of Mines in cooperation with the Air Reduction Sales Company. G. E. Harcke, industrial engineer for the latter Company, gave a talk on the same subject.

A special feature of the meeting was an actual demonstration of machine flame-cutting devices.

Reports by various members who attended the Atlantic City Meeting were given and a discussion of the proposed Ceramic Department at the University of Missouri was given.

PITTSBURGH LOCAL SECTION[2]

Members of the Pittsburgh Local Section of the SOCIETY held a meeting on the evening of March 20 in the Auditorium of the Pittsburgh Section of the U. S. Bureau of Mines. The address of the evening was given by Dr. Albert Sauver, Professor of Metallurgy of Harvard University. His subject was "The Behavior of Steel under the Action of Heat."

DENVER NOW IN SUMMER MEETING SCHEDULE

Attractive Addition Made to Itinerary

Daily increasing interest in the plans for the Summer Meeting tour to the western coast of the United States is being manifested by the members of the AMERICAN CERAMIC SOCIETY. The latest announcement that Denver will be visited on the return trip

[1] L. C. Hewitt, Secretary.

[2] H. G. Schurecht, Secretary.

with the Denver ceramists as cordial hosts has been greeted with enthusiasm. This latest addition to the itinerary has been made with *no* additional railroad fare.

The ceramic party will leave Los Angeles for Grand Canyon and after a visit there will go directly to Denver for plant and social visits.

The itinerary for the four weeks' trip is as follows:

Leave Chicago	July 21
Spokane	July 25
Seattle	July 26–28
Lincoln	July 30
San Francisco	July 31–August 2
Yosemite Valley	August 4, 5 and 6
Los Angeles	August 7, 8 and 9
Grand Canyon	August 10
Denver	August 13

Chairman Ortman of the Western Committee sends enthusiastic accounts of the plans being perfected for the comfort and enjoyment of the visiting ceramists and their families.

Members are requested to send in their names for reservations to the Office of the Secretary, Lord Hall, O. S. U., Columbus, Ohio, on or before June 1, 1924.

OFFICERS OF THE GLASS DIVISION

G. E. Barton, Chairman of Glass Division

G. E. Barton, elected chairman of the Glass Division at the Atlantic City Meeting, was born at Worthington, Mass., May 9, 1871, of old New England stock. He received the degree of B.S. from the Worcester Polytechnic Institute in 1891, and M.S. from George Washington University in 1895. He was assistant Chemist at the Naval Torpedo Station, Newport, R. I., 1891–92, Chemist to The Aetna Powder Co., Aetna, Indiana, 1892–94; and private assistant to Dr. Charles E. Munroe, the explosives expert, 1894–96.

From 1896 to the present he has been the chief scientific advisor of Whitall Tatum Company. This concern made and marketed the first American borosilicate glass, for other than optical purposes, as "Nonsol" Chemical Ware in 1902.

G. E. BARTON

He is a member of the AMERICAN CERAMIC SOCIETY, The American Chemical Society, The Society of Chemical Industry (London), The Societe de Chemie Industrielle (Paris), The American Institute of Chemical Engineers, The Society of Glass Technology (England), and a fellow in The American Association for the Advancement of Science.

In the American Chemical Society, he served on the Committee on "Graduated Chemical Glassware" which convinced that organization of the necessity of a Bureau of Standards and which was active in obtaining the passage by Congress of the Bill creating the

same. Correspondence which he had with President Hillebrand of the same Society in 1906 led to the appointment of a committee of which he was a member on the relation of industrial chemists to the Society. The work of this group led to the publication of *Chemical Abstracts* in 1907, and of The *Journal of Industrial and Engineering Chemistry* in 1909. He also has served the same organization as Associate Editor of The *Journal of Industrial and Engineering Chemistry,* Assistant Editor of *Chemical Abstracts* during its entire existence, Councillor from 1908 to the present, and Chairman of the Philadelphia Section in 1921.

ALFRED N. FINN

Alfred N. Finn, Newly Elected Born and educated in Denver, Colo. Graduate of the University of Denver, A.B. (1906), A.M. (1909), having specialized in chemistry, mathematics and physics. Instructor in Chemistry, University of Denver, until appointment at Bureau of Standards in 1911. After eight years in chemical testing of structural materials, he resigned to enter the Research Department of the Hydraulic Steel Co., Cleveland, Ohio. Reinstated at Bureau of Standards in 1920 in his present position in the Glass Section. He is a member of the American Chemical Society, 1912, American Society for Testing Materials in 1913, AMERICAN CERAMIC SOCIETY, 1922, and the Optical Society of America, 1923.

NOTES AND NEWS

SOCIETY OF GLASS TECHNOLOGY MEETINGS

The February meeting of the Society of Glass Technology was held in Sheffield on February 20. In the morning there was an exhibition and demonstration of modern pyrometers at the Department of Glass Technology of the University. The following firms exhibited:

1. The Bowen Instrument Co., Ltd.
2. The Cambridge & Paul Instrument Co., Ltd.
3. The Foster Instrument Co.
4. The Optical Pyrometer Syndicate.
5. Messrs. Booth & Miller also demonstrated their New Temperature Controller.

At the afternoon session the subject under discussion was "The Use of Pyrometers in Glass Works." Five papers were presented.

I. "The Use of Pyrometers in Glass Works," by E. A. Coad-Pryor The value of pyrometric equipment in a glass factory depends essentially on three factors:—

1. The reliability of the pyrometer itself, particularly the clock-work;

2. The skill which is expended on its maintenance; and

3. The attitude with which the management, foremen and furnace operators regard the pyrometer.

Of these three the last was regarded as the most important. The pyrometer in no way displaced the trained eye; its real function was to supply further information

in order that a highly skilled operator might be able to get more out of his plant than had hitherto been possible.

The range of temperatures to be measured could conveniently be subdivided into 3 groups.

1. The range 0° to 700°C, covering leers, stack temperature, producer gas, etc.
2. From 700° to 1200°C, regenerator temperature, pot work, and
3. Above 1200°C, the temperature of the melting furnaces.

In the first group the thermocouple was the most convenient instrument to use. Some sort of a portable thermocouple should be part of every works equipment. A convenient couple for low temperature work was iron-constantan: the wire to be about 22 gauge.

In the high temperature ranges an optical or total radiation pyrometer was, as a rule, the most convenient. The tank furnace might be subdivided into 3 zones: the melting zone, the plaining zone, and the refining end. Two permanent pyrometers should be used on each furnace, one on the refining and the other sighting through a hole in the end wall at the melting end of the furnace. The use of couples embedded in the wall of the tank or in the crown caused probably more trouble than they were worth.

The optical or radiation pyrometer if used with discretion, was the most reliable and the most easily applied. The author's experience was that the optical instruments gave less variable readings than did the radiation instruments. The all important factor with any installation was the training of the staff and operators to use the instruments with intelligence as an aid to the maximum efficiency in furnace manipulation. A bibliography was added to the paper.

II. Continuous High Temperature Measurements in Glass Works, by W. M. Clark

In the strictest sense of the term there was probably no absolutely accurate method existing for constantly determining glass house temperatures. We could only approach this desirable aim by refinements of installation and careful maintenance, and this meant both equipment and maintenance expense. Therefore, in considering the subject of a pyrometer installation the glass manufacturer must balance the factors of what his demands for accuracy will be worth against the initial and operating costs of various systems. It is always advisable to install both the indicating and recording type of instrument, side by side.

Experience at a number of modern well laid out plants showed that pyrometric measurements were reflected in the costs sheets. The morale of the furnace men was improved by eliminating the human errors of judgment in guessing at temperatures and cost per unit of output decreased. With improvements in pyrometric equipment the tendency was for their more extensive use around glass works. The depreciation on such equipment was not excessive, about ten per cent per annum being a fair amount, judging from successful installations and as improvements came along they could be incorporated into the system, replacing features which became obsolete and thus keeping the installation up to date. A well-planned system would reduce overall costs in a year more than sufficient to pay for the investment and often would leave several times this amount if used intelligently.

The most forceful argument for the adoption of pyrometer control in a glass works was on the score of economic savings but the information, thereby made available to the management and staff, was also important in showing each man a tangible effect of his operation on the thermal conditions. The producer man saw that good gas was necessary to maintain temperature, the furnace man saw the result of proper draft

regulation, the foreman of the finishing department could be satisfied whether the ware was being properly annealed and the whole schedule of production was benefited.

III. Recent Advances in the Design of Temperature Measuring Instruments, Etc., by R. W. Whipple

One difficulty in connection with disappearing filament pyrometers was to get two lamps which would be interchangeable. Methods for overcoming this difficulty were indicated. The speaker then said how greatly he had been impressed with what he had seen recently in the United States in the matter of automatic temperature control. He understood considerable work was being done in this connection in glass works and referred to the works of Messrs. Keuffel & Esser when leer temperatures were controlled from 200°C to 600°C. For every kind of glassware a special cooling curve was followed. In the United Kingdom automatic temperature control was being developed. The main principle in such control was a galvanometer needle which was deflected by some method. Lantern slides were then exhibited showing various forms of controller, including (1) Brown, (2) Bristol, (3) C. Engelhard, (4) Leeds & Northrup, (5) Cambridge, (6) Barr, (7) Althorpe. It should be possible to control leer temperatures by some such automatic control apparatus, and so to lessen the worries of the works manager.

IV. Practical Applications of Pyrometers to Glass Works, by C. E. Foster

Both optical and total radiation instruments were calibrated for what was known as "black body" condition and when used on hot bodies which were not technically known as "black bodies," the reading would be in error by an amount which varied with the actual condition. An ordinary large glass melting tank was by no means a "black body." The author suggested that luminous gas flames might have the power of selective emission, that is, they radiated a light which was not in proportion to their temperature, but might be of an intensity which would correspond to the brightness of a solid hot body at a much higher temperature. Considering a surface of molten glass viewed obliquely in a furnace that did not realize "black body" conditions, it obviously had a considerable reflecting power, but he found that its reflecting power as experienced in measuring with a total radiation pyrometer was relatively much less than the unoxidized surface of molten metal. Further consideration showed that this was reasonable because there was some considerable transparency in the glass so that it would actually emit a greater proportion of the heat from inside. Thus it was actually found that molten glass approached more nearly to a true "black body" than unoxidized molten metal.

V. Reflections on Pyrometer Design, by W. Bowen

Economy in fuel consumption, long life of furnaces or other heating devices employed, elimination of waste of raw materials and of irreparable losses of finished products all depend upon the raising of the heat-treated materials to no less, and no more, than the requisite temperatures. The value of pyrometers to such heat-treatment problems was now too well recognized to need discussion. A few of the standards which a good pyrometer should fulfill were as follows: (*a*) Simplicity of design and operation, (*b*) Robustness and freedom from liability to breakdown under shock or accident, (*c*) Flexibility of apparatus to meet the practical conditions, (*d*) Long and stable life of pyrometer, (*e*) Speedy response to temperature changes, (*f*) Automatic action, (*g*) Accuracy. These standards were then discussed with reference to the new "Pyro" radiation pyrometer, an instrument compact in shape, extremely portable and simple in operation.

The January Meeting.—A meeting of the Society of Glass Technology was held in the College of Technology, Manchester, on Wednesday, January 16, 1924, the Pres-

ident, W. E. S. Turner, being in the chair. A paper by the president on "Specifications for Glass" formed the basis of an interesting discussion. J. H. Steele directed attention to a circular which he had received in which the use of glass for food containers was attacked. It was further stated that glass splinters were a possible cause of appendicitis and cancer. E. A. Coad-Pryor suggested the desirability of having some open preliminary specifications based upon durability alone. What was needed was some simple test which could be easily applied in the works. Fuller specifications could be made as experience accrued. Professor Turner in the course of his reply said that his attention had already been directed to the circular to which Mr. Steele referred. As the matter was one of some importance to the glass industry he had felt constrained to consult some of the leading pathological and surgical experts in this country and to obtain their views on the subject. The answers which he had received very definitely refuted the charge that glass splinters was a cause of either appendicitis or cancer.

The next paper considered was entitled "The Production of Colorless Glass in Tank Furnaces, with Special Reference to the Use of Selenium" by A. Cousen, and W. E. S. Turner. Mr. Cousen summarized previous work done by the authors on this subject and gave the results of their latest experiments. Some types of commercial glass, including modern colorless glass jars, began to turn yellow when exposed for some time to light. This happened when stacks of jars were kept for a time in the open yards of glass factories. It was now shown that glasses which had been decolorized by selenium, together with arsenic showed this yellowing effect on exposure to sunlight. On the other hand, glasses which were originally yellow, due to the presence of selenium without arsenic, became bleached by sunlight. It had previously been observed that the yellow selenium glasses when reheated to temperatures of 500° to 600°C became distinctly deeper in color, the maximum deepening being reached at a temperature of about 550°. When, however, a number of pink glasses such as are obtained by melting batches containing selenium along with arsenious oxide or sodium nitrate are reheated at the same temperatures, distinct loss of color occurs. This loss is slow at 525° but is very appreciable even after an hour at 575°, the upper annealing temperature of the glass itself. Such a color change would be obtained in a leer when the pink glasses were being annealed, and would call for careful regulation of the temperature during the process.

A paper emanating from the Department of Glass Technology of the University of Sheffield and entitled "Further Contribution to the Study of the Effect of Alumina in Glass," was taken as read.

COLONEL PRATT IN NEW WORK

At the meeting of the State Geological Board, held in Raleigh, February 1, Colonel Joseph Hyde Pratt, who is *ex officio* Director of the State Geological and Economic Survey, tendered his resignation as State Geologist, a position he has held since 1906.

Colonel Pratt is now actively engaged in his new work as President of Western North Carolina, Inc., an inter-county association whose purpose, as its name indicates, is the advertisement and general development of the resources and material and social possibilities of the rapidly prospering mountain section of the State.

The new director is Brent S. Drane, civil engineer of Charlotte, N. Car.

CZECHOSLOVAK CERAMIC SOCIETY

By Rudolf Barta[1]

The first meeting of the Czechoslovak Ceramic Society in Praha.

New Ceramic Society, Organized in December, 1923

Czechoslovakia has long stood in need of a scientific center in ceramics. This country abounds in first class raw materials and her ceramic industry is on a high level. Therefore, on December 11 the ceramic engineers founded in Praha, the Czechoslovak Ceramic Society. It is the fifth corporation of this kind in the whole world, and the second on the Continent of Europe. The Society is organized after the American model. The membership for foreigners is Kč 50, for a Society Kč 500.

Dr. Frank Fischer,
The first president of the Czechoslovak Ceramic Society.

The *Journal* of the Society will appear occasionally. As three of the ceramic societies use the English language, our *Journal* will contain English abstracts.

Up to this time the work of our ceramists has not been known abroad, as most of our works have been written in the Czech language, which is not much known abroad.

Foreign countries have heard of us through foreign newspapers, and therefore we were supposed to belong to other nations. The interest for this new society is very great throughout Central Europe.

The first elected president is Frank Fischer, one of the most distinguished workers.

The Czechoslovak ceramists would be pleased to enter into scientific connections with the Americans.

[1] Secretary of the Czechoslovak Ceramic Society.

RESEARCH FELLOWSHIPS

At the College of Mines, University of Washington and the Northwest Experiment Station, U. S. Bureau of Mines, 1924–1925

The College of Mines of the University of Washington offers five fellowships for research in Mining, Metallurgy, and Ceramics in coöperative work with the Bureau of Mines. The fellowships are open to graduates of universities and technical schools who are properly qualified to undertake research investigations. The value of each fellowship is $810 per year of twelve months, beginning July 1st. Fellowship holders pay the usual tuition and partial laboratory fees; they register as graduate students and become candidates for the degree of Master of Science in Mining Engineering, or in Metallurgy, or in Ceramics, unless an equivalent degree has previously been earned.

The purpose of these fellowships is to undertake the solution of various problems being studied by the United States Bureau of Mines that are of especial importance to the State of Washington, the Pacific Northwest, and Alaska. The investigations consist principally of laboratory work directed largely by the Bureau's technologists. For the year 1924–1925 the following subjects have been selected for investigation:

(1) Beneficiation of coal, especially coal washing.

(2) Electrometallurgy. Iron and steel problems. Super-refractories.

(3) Ceramics. Super-refractories, whiteware bodies, and other problems.

For information write to Dean Milnor Roberts, College of Mines, University of Washington, Seattle, Washington.

BUREAU OF STANDARDS

Exhibit of Ceramic Ware

The Bureau of Standards at Washington, D. C., is sending to the various manufacturers of vitrified and semi-vitrified ware, enamelers, manufacturers of glass, art pottery concerns, and in fact to the manufacturers of every variety of ceramic ware, a form letter requesting that they submit a few samples of their product which is either intricate in shape or has some artistic value.

These samples are to be placed on permanent exhibit. Such an exhibit will be of benefit to every one concerned since it will bring before the many visitors to the Bureau the products of the American ceramic industry. The Bureau has gone to considerable trouble to prepare an adequate case for these exhibits and is making every endeavor to present them in such a way that they will appeal to the popular eye.

"Cut-Offs" for Glass Bottle Machines

For some time the Bureau has been investigating the material used for "cut-offs" which are employed to control the flow of glass in automatic bottle machines. Ten shapes were made up during the past month, using two bodies which have been found to be resistant to glass attack and spalling. It has been thought that casting instead of pressing would eliminate some of the trouble now experienced in the industry through the failure of these "cut-offs."

Judging from the raw batch of bodies sent in by manufacturers, a change in body will be necessary if casting is to replace pressing, as the present one is too deficient in plastic clay and probably contains too much impurity to cast successfully.

Compressive Strength of Sand-Lime Brick Walls

Ten sand-lime brick walls and 12 wallettes were tested in the 10,000,000 lb. vertical machine during the month. Half of these were built with cement-lime mortar and half with lime mortar. The tests showed the former to be more than twice as strong and roughly about ten times as stiff as those built with lime mortar.

The latter walls, however, showed a compressive strength of about 300 lb. per sq. in., which means that under its own weight such a wall would have to be 350 feet high before it would crush at the bottom.

Judging from the opinions of various engineers and others who have witnessed these tests, the results, covering as they do unusually large wall specimens, will furnish very valuable data for use in future construction.

BUREAU OF MINES NOTES

Refractory Kiln Survey A number of operators of refractory kilns have asked the Department of the Interior to detail engineers of the Bureau of Mines to look over their burning conditions with the idea in view of determining whether it is likely that a saving in fuel could be effected by a service similar to that rendered to the refractories manufacturers by the Bureau last year. This work will be in coöperation with the Refractories Manufacturers Association.

Burning Problems of Industrial Kilns Important fuel economies in the operation of industrial kilns manufacturing brick, tile and other heavy clay products have been made possible as the result of a study of the burning problems of such kilns, made by the Department of the Interior in coöperation with the Four Heavy Clay Products Associations. In the course of the investigation, engineers of the Bureau of Mines, traveling on a specially-equipped laboratory car, conducted studies of actual firing conditions at typical plants producing common brick, face brick, paving brick, and hollow building tile. The practical demonstrations of the Bureau of Mines engineers resulted generally in a considerable reduction of time of burning, a material lessening in the amount of fuel consumed, and improvement in the quality of the manufactured product. The results of this investigation have been incorporated in a report on "The Burning Problems of Industrial Kilns," published by the Four Heavy Clay Products Associations, composed jointly of The National Paving Brick Manufacturers Association, The Common Brick Manufacturers Association, The American Face Brick Association, and the Hollow Building Tile Association.

Utilization of Anhydrite The anhydrous form of gypsum, which occurs in large quantities in some mines, is difficult to utilize. In the hope of obtaining information which may lead to a more efficient utilization of such types of gypsum, a study of the chemical and physical properties of the whole series of calcium sulphates has been undertaken by the Department of the Interior at the Non-Metallic Minerals Station of the Bureau of Mines, New Brunswick, N. J. The bureau will attempt to determine (1) the stability of gypsum and anhydrite in their relation to gypsum ore reserves and (2) the properties of anhydrite in their relation to better utilization. A preliminary study has been made of physical-chemical work that has already been accomplished, bearing on this subject. Samples of anhydrite and gypsum have been obtained from gypsum mines.

Refractories for the Melting of Platinum Last month a sample of fused zirconium oxide was obtained from a company which is developing the production of fused zirconia on a commercial scale. Small crucibles of this fused zirconia have been made in the laboratory without an added oxide bonding material and with additions of 20% thoria or 15% aluminum. Very promising results have been obtained since several of the crucibles have satisfactorily withstood very sudden and uneven heating in the oxyacetylene flame and even quenching in water from temperatures as high as 1700° or 1800°C. Actual melting tests with platinum will be carried out in the induction furnace as soon as possible.

REQUEST FOR UNPUBLISHED DATA

The Editorial Board of International Critical Tables will appreciate receiving from scientific investigators any numerical data which they are able and willing to furnish, which have not been published prior to January 1, 1924. All data are desired which characterize the behavior of any definite material, substance or system. For the purpose of this request, such data will be divided into two classes, as follows: Class I, data which constitute the only information of the kind available; Class II, data which, in the opinion of the investigator, substantiate, extend or improve upon existing information of the same kind.

In connection with data belonging to both classes, the following information should be given: (*a*) an exact definition of the material, substance, or system to which the data apply; (*b*) the investigator's estimate of the accuracy of the values; (*c*) the name of the investigator or investigators responsible for the measurements; (*d*) the laboratory in which the investigations were carried out; (*e*) a brief statement of the experimental method used; (*f*) an exact statement of the units in which the data are expressed; and (*g*) any other supplementary information necessary for the complete characterization of the data.

For data belonging to class II, such additional data should be furnished as will enable the expert in charge of this class of data to critically evaluate the new in comparison with the older data. Manuscript or corrected page proofs should be furnished where possible.

Any data belonging to class I received prior to January 1, 1925, and any data belonging to class II received before July 1, 1924, will be in time for inclusion in "International Critical Tables," and the source of all data so included will be indicated by "Private Communication from," etc., or in such other manner as the author may prefer, unless a literature reference becomes available before going to press. Data determined by members of the staff of a research laboratory should be forwarded through the Director of the laboratory. All data should be sent to "International Critical Tables," National Research Council, Washington, D. C.

ELECTRIC FURNACE REFRACTORIES

The American Electrochemical Society will have a round table discussion of electric furnace refractories in New York City, April 24. They desire that as many as are interested shall attend. Dr. M. L. Hartman of Carborundum Co., Niagara Falls is in charge.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21– Aug. 1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
American Electrochemical Society	April 24	New York City
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn., Inc.	Oct., 1924	

Organization	Date	Place
Am. Iron and Steel Institute	May 23, 1924	New York
Am. Zinc Institute, Inc.	Apr. 28–29, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	Apr. 25–26, 1924	Washington, D. C. Bureau of Standards
British Assn. for the Advancement of Science	Aug. 6–13, 1924	Toronto, Canada
Chamber of Commerce of the U. S. A.	May 6–8, 1924	Cleveland, Ohio
Chemical Equipment Assn.	Sept., 1924	
Eastern Clay Products Assn.	Apr., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec. 9, 1924	New York (?)
Glass Container Assn. of Amer.	Apr. 25, 1924	Atlantic City
Glazed and Fancy Paper Mfrs. Assn.	Wk. of Apr. 7, 1924	New York
Manufacturing Chemists' Assn.	June, 1924	New York
Natl. Assn. of Mfrs. of U. S. A.	May 19–21, 1924	New York
Natl. Assn. of Stove Mfrs.	May 14–15, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	Last Wk. Apr., 1924	Atlantic City
Natl. Glass Distributor's Assn.	Dec., 1924	Pittsburgh
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Mfrs. Assn.	Dec., 1924	
Penna. Gas Assn.	April, 1924	Atlantic City
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	May or June, 1924	
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh
Western Society of Engineers	June 4, 1924	Chicago

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Vol. 3 — May, 1924 — No. 5

EDITORIAL

COÖRDINATING RESEARCH AND TECHNICAL INFORMATION WITH PLANT CONTROL[1]

By J. A. Jeffery

Introduction

No industry can expect to enjoy prosperity and maintain supremacy over a period of years that depends on patents or secret formulae.[2] A wide awake competitor with research facilities will discover new and better ways of accomplishing the same results within a more or less limited period. A manufacturing enterprise must advance scientifically, but this cannot be accomplished without proper organization and equipment.

As a nation we are restless and ever anxious to work out new methods, in fact it is almost a national vice to discard the old and experiment with new ideas and devices. To a great degree our patent laws are responsible for this situation as they encourage inventions through profits that are expected to accrue from the monopoly they intended to create over a period of years; but there is a deeper instinct involved, that of industrial progress which is born in us.

It is unfortunate that we are so prone to take short cuts instead of methodically searching the literature that is so abundantly available.

[1] Presented at the Atlantic City Meeting, Feb., 1924. (General Session.)

[2] Italic is by the editor.

One of the saddest things we can imagine is to find a man laboring for months, or years, over a problem that has been worked out long before his time and which even a limited survey of text would have disclosed to him. The average man seems possessed with the thought that a clever idea he may have conceived is new and worthy of protection through patents, and it is to be regretted that so many Patent Attorneys encourage such clients and that the Patent Office in turn issues such an endless chain of worthless patents. However, this difficulty is not confined to the individual, for many industrial organizations are spending great sums of money and valuable time in just such useless efforts through lack of a suitable research and engineering organization.

FIG. 1.—Ceramic laboratory. Preliminary tests are made here on all raw materials before accepting them.

It is well to lay special stress on the fact that *pure Research cannot be well conducted in a manufacturing enterprise by a single individual.* As a rule the results of this work would be almost useless to the business itself owing to the fact that a man mentally equipped to delve deep into nature's secrets, rarely has the engineering genius to put his discovery into workable form. Therefore, we should have in addition to the scientist or research worker, an engineering force capable of working out the practical application of the discovery or invention.

Research Organization

In coördinating the research with production it is essential to have the organization so arranged, that coöperation is maintained. There must be someone in the personnel who is experienced in both the production and experimental work to such an extent that success will result when experiments finally become production problems. Here is one place particularly where a special department, such a one as our Process Laboratory which will be described later, plays an important part.

FIG. 2.—Chemical laboratory. All materials are analyzed at intervals. Every carload of some materials is analyzed.

A well-planned research division in any industry includes first of all of course an efficient well trained personnel, whose activities are guided by a research director who *must* be a man of broad training and experience. And for successful research and plant control the necessary laboratories and departments must be available, and in our work we have found the following to be indispensable:

1—Ceramic Laboratory
2—Chemical Laboratory
3—Electrical Laboratory
4—Mechanical Laboratory
5—Testing Laboratory
6—Petrographic Laboratory
7—Library
8—Record and File Clerk
9—Legal Department

Conditions which arise in coördinating research and technical information with plant control are so numerous that it is very difficult to cover the entire field in a general way. Bearing this in mind it is the writer's

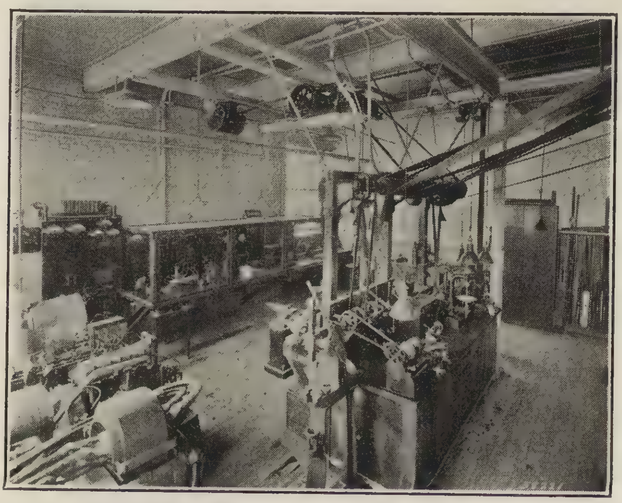


Fig. 3.—Electrical laboratory. Equipped for testing spark plugs, calibration of thermocouples and building of small electrical equipment if special.

opinion that he can accomplish more by presenting the details which have arisen in a ceramic plant. This is particularly so in this case as it is the ceramic industry that we desire to deal with.

Routing of the Work

All ideas, conceptions, or requests for information originating in the factory or within the Research Division itself, must be referred to the Director and by him assigned to the laboratory or individual best equipped to handle this problem.

Origin of the Problems

Quite frequently the problem is so complex that several divisions must be called upon to solve certain parts of it, for instance—quite frequently it is discovered through the Sales Organization that a competitor has developed some radical improvement. Let us suppose this to be a porcelain article that is subject to tensile stresses. How then should this be handled?

Through the Research Laboratories

Experience has long since taught us that the microscope should be first employed and a careful examination made to disclose any new mineral that might have been used in the body, as well as to indicate the character of the porcelain as to grain fineness; degree of solution of the silicates such as quartz; the quantity and character of the crystal development; and the probable temperature of burning.

Fig. 4.—Mechanical laboratory. Many special machines and instruments are made here.

The Petrographer would then report his findings to the Director, and in turn the Chemical Laboratory would be called upon to make a complete analysis; then from its results, the Ceramic Laboratory would be called upon to reproduce the body or porcelain of like character and improve upon it if possible.

Obviously, if the porcelain is to be fabricated in the form of an insulator we must now call upon the Mechanical and Electrical Laboratories to make tensile and shock tests on the finished article, as well as to establish the electrical values at atmospheric and elevated temperatures.

In an industry of considerable magnitude it is evident that a large staff is necessary to carry on consistent research and at the same time take care

of manufacturing problems as they arise. As a matter of fact if a highly specialized product is made, not only careful physical tests of raw materials are necessary but accurate chemical analysis of nearly all raw materials is absolutely essential. Not less than two men should be steadily employed in the work of checking raw materials.

THE PROCESS LABORATORY Let us now assume that it is desirable to put a new body or formula into production. At first thought this seems a simple matter, but it frequently takes at least a year to iron out many of the problems that arise when we attempt operations on a large scale. In our industry a multiplicity of troubles arise from the complex nature and properties of the matter we know as clay and the peculiar reactions that take place in burning.

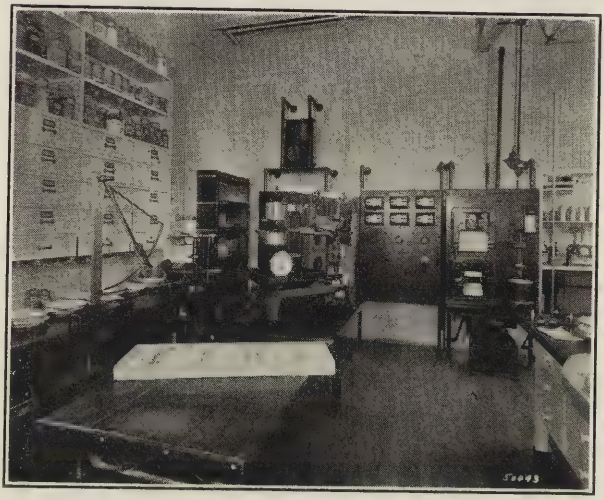


Fig. 5.—Testing laboratory. All plant control tests on production ware are made here, such as impact, thermal shock, electrical resistivity at increased temperatures and the like.

The difficulties involved in introducing a new body into full production in the factory led us to equip what is known as a Process Laboratory, the function of which is to prepare and fabricate the new composition on a small production scale. As a matter of fact this laboratory is a small yet complete manufacturing plant itself, equipped with full-sized units which are exact duplicates of the factory equipment including mills, pugs, forming machines, glazing machines, kilns, etc. Obviously the new body can be then produced in considerable quantity over a period of time sufficient to permit accurate study of its behavior and the effect of different lots of material, as well as its behavior over the full range of burning temperatures.

During this period accurate records are kept of the speed of operation and the percentage of good ware produced, as well as average mechanical and electrical values. If possible, the body is adjusted to give the same shrinkage as the body in production in the factory. If this is not possible,

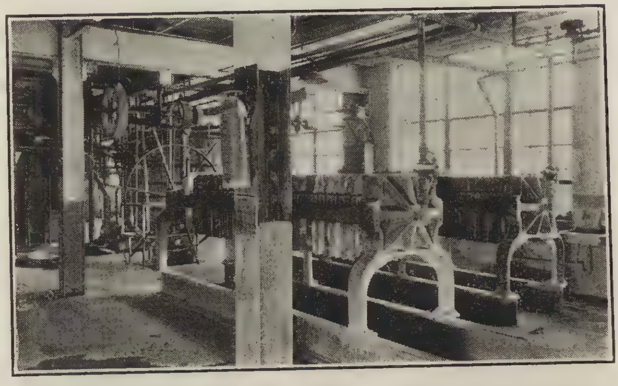


FIG. 6*a*.—Process laboratory slip house containing six-foot pebble mill, blunger, lawn, magnetic separator, filter presses, etc.

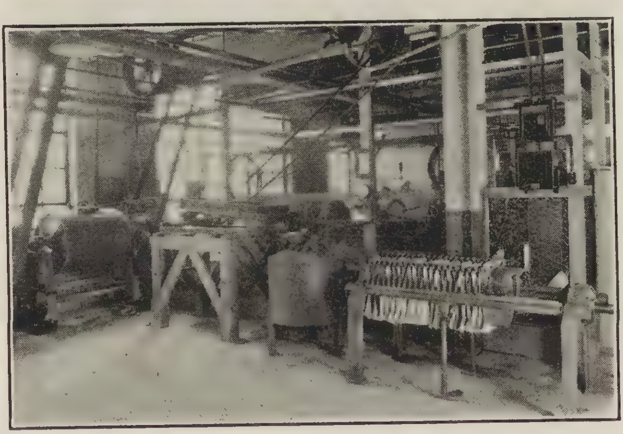


FIG. 6*b*.—Process laboratory slip house containing thirty-inch pebble mill and other necessary equipment of proportionate size.

then all dimensions are accurately worked out so that the equipment can be altered to conform to the new shrinkages.

In the usual order of events radical composition changes are not frequently necessary and the continuous employment of a trained Process Laboratory force would not be warranted. However, there is another and more important function performed by this department.

Function of Process Laboratory in Quality Control

In the manufacturing of a highly specialized product it is essential to rigidly control the properties of the porcelain body and this is best accomplished by preparing the body in 40,000 lb. dry-weight batches which are stored in separate masses after weighing, milling, and filterpressing. Within a day or so after the body has reached the aging cellar a few hundred pounds is

Fig. 7.—Process laboratory containing one full production size pug mill for blanks and one-half size.

withdrawn and taken to the Process Laboratory where it is pugged, dried, formed, glazed and placed in specially marked saggers which are burned through the tunnel kiln, then returned to the Process Laboratory for final inspection and tests. If this lot of porcelains passes all standard tests, the 40,000 lb. batch from which they were made is released to the Production Division; but close check is advisable and if practical, each batch should be traced through the Production Division and at least one piece of the finished product, and more if the article manufactured is small, should be selected from each kiln car or sagger and subjected to final tests. The final tests should in no case be trusted to the Production Division, for as a rule the latter is only seriously concerned with quantity and can hardly be expected to watch the quality.

Fig. 8.—Process laboratory. Turning department equipped with six standard sized machines and independent means for catching the body dust.

Importance of Patent Protection

One of the most important responsibilities of the Director of Research in a modern industry is to protect the work of his division through patents. Too much emphasis cannot be placed on the necessity of great care in selecting proper legal advice. A Patent Attorney should preferably be selected who has had not only a wide experience but one who has specialized in the particular industry with which we are concerned. To be competent to handle the legal end of such an industry as ours, he should have a fair knowledge of engineering and chemistry and must familiarize himself with much of the ceramic literature and foreign patent art.

Fig. 9.—Process laboratory. Automatic glaze spraying machine. One operator puts the unglazed green cores on the revolving spindles. These pass by the atomizers and are coated with glaze, removed by the other operators and placed in saggers.

If proper steps are not taken to protect inventions that originate in the Research Division or that are worked out from suggestions from the factory, it would be difficult to show that any results have accrued from the activities of this department.

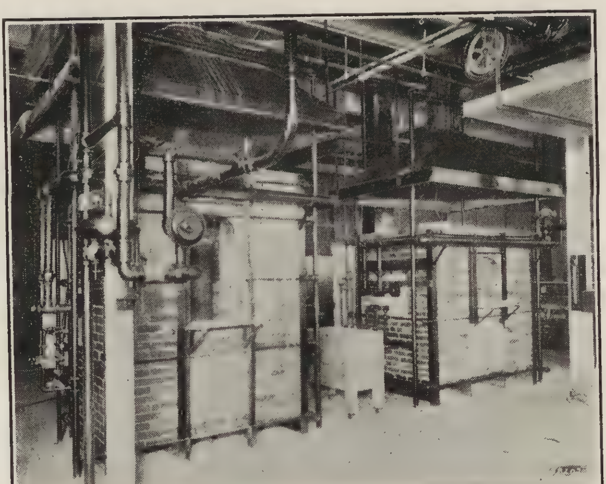


Fig. 10.—Process laboratory kilns. One will hold 1200 cores, the other half that amount. Ordinarily all tests are put through the production kilns.

Secured Assurance of Benefit from Acquired Knowledge of Employees

As a rule the men who are employed to carry on the work in the Research Laboratory are selected for their particular ability or education. Generally they take the position expecting to seek a better one after having had the benefit of practical training and experience. The realization of this often is a severe disappointment to the employer, but on the other hand the type of man that is valuable in research work and to his department is almost certain to be ambitious and restless for further experience or advancement. Obviously, then the benefit of their work would be lost were they to leave the organization to take a somewhat similar position with a competitor. It is easy to see how the results of much of their work would then pass directly into the hands of the new employer who is probably provided with means and equipment to reap the benefit of their work to the detriment of the concern that had made their former activities possible.

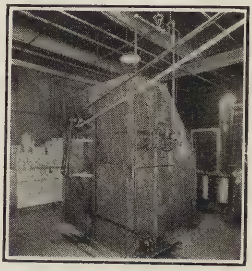


FIG. 11.—Process laboratory dryer equipped with automatic control.

Protection against Unfair Competition

It is a well known fact that there are many manufacturers who do not hesitate to prey upon and pirate ideas that are the property of others, actually believing they have shown keen business ability in so doing. It is fortunate, however, that the courts now frown on such tactics and it is becoming less difficult to establish the fact of unfair competition or intent to defraud. Patents, however, are not our only protection and the possibility of even more adequate protection through design patents and trade marks should not be overlooked. Infringement of patents is sometimes difficult to establish, whereas, unfair competition or intent to defraud the public is much more easily proven and in some instances the Post Office Department can be called upon to punish the offender and thus protect both the manufacturer and the public.

FIG. 12.—Plant control tests. The impact test is made by dropping a weight a definite distance onto the end of a porcelain core held horizontally in a firm position.

Patent Rights of Employer and Employee

Before a man is employed or added to the staff of the Research or Engineering Division of a modern industry, the importance of protection should be explained to him and he should be required to sign a suitable and fair agreement to convey the title of all inventions to the Company that employed him, thereby saving both parties much annoyance and expense as well as endless argument, should a dispute ever arise. It is not pleasant to have legal actions arise from lack of a clear understanding of a man's duties and the purpose of his employment. It is easy to assume that he is attached to the Research Division for the purpose of improving the product, and equally reasonable to assume that inventions thus created or conceived belong to the employer, but it is another thing to prove this if suitable documentary evidence is lacking. In the case of a disgruntled employee it is surprising how he will try to evade responsibility and claim that an invention or conception is his property and only shop rights belong to the employer.

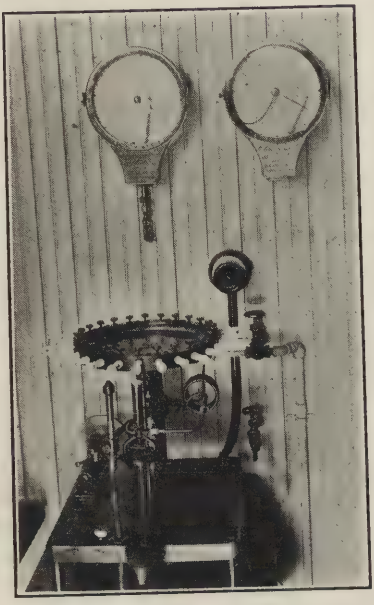


Fig. 13.—Plant control tests. The heat test consists in suddenly exposing the end of a cool porcelain to the flame of a meeker burner and leaving it there for 60 seconds. All conditions as to temperature, time, etc., are accurately controlled.

The writer sincerely believes that these relations should be thoroughly understood and the agreement between the employer and laboratory worker be complete and fair to both, otherwise distressing arguments are certain to arise resulting in a direct loss to both parties, as cordial relationship should continue to exist after a man seeks a new position. From time to time an exchange of ideas may be of great benefit to both parties.

Duty of Research Director to Publish

There is another angle that should receive serious consideration for the benefit of the industries at large. *Until we have adequately organized and financed Research Bureaus that are supported by such industries as ours, I believe it to be the duty of the Director of Research in an industry to publish at proper intervals the results of research that cannot be considered an essential shop secret.* The publication of such matter through papers presented

before the societies representative of the industry in question, makes this information available to others who might otherwise spend much time and effort covering the same field. A good example might be cited as follows:

In the development of 18 and 19 cone bodies no small part of the problem was to find suitable kiln refractories and containers or saggers. Obviously, in this development many features were accomplished that will result in great economies in the 11-12-13 cone field, and the publication of such developments cannot injure the interests of investigators.

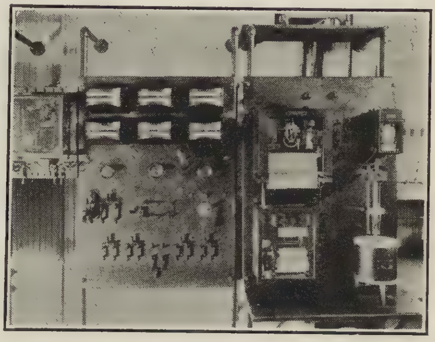


FIG. 14.—Plant control tests. The hot dielectric test determines the electrical leakage of the porcelain at increased temperature as well as the temperature at which the final failure occurs. All conditions must be constant and accurately controlled.

Less Secrecy and Greater Exchange of Information

In closing, the writer desires to plead for less secrecy and greater exchange of information and ideas. With a well organized research staff and modern laboratory equipment there is little protection possible through secret formulae. With an experienced petrographer, a capable chemist, and a ceramic engineer any porcelain article now manufactured can be duplicated if desired, hence there is little to be gained by secretiveness. No fair-minded man can expect to receive information if he is not willing to reciprocate.

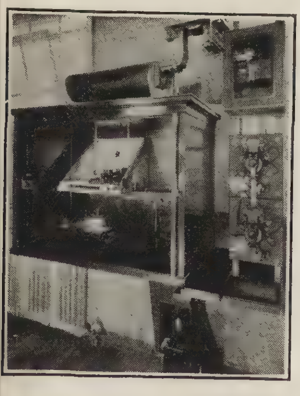


FIG. 15.—Plant control tests. Equipment built in our own laboratories and designed to determine thermal expansions up to 1100°C.

Value of Broad Training

The Schools and Colleges should encourage the young ceramic engineer to gain the broadest possible experience along other lines of engineering, particularly those applied in our ordinary manufacturing plants. There is an old saying that the most uncommon thing in the world is common sense, but we can truthfully state that men capable of assuming the duties of Research Director or Plant Manager in the modern progressive ceramic industry are as scarce as the proverbial

"hen's tooth." There is a fine field for rapid advance with unusual monetary compensation for the men with wide practical engineering experience and good knowledge of works control.

THE CHAMPION PORCELAIN CO.
DETROIT, MICH.

PAPERS AND DISCUSSIONS

ECONOMIC FACTORS THAT MAKE RESEARCH IN INDUSTRY IMPORTANT[1]

By William R. Mattson

What I wish to bring to the members of the American Ceramic Society is the relationship of general business to research and also a few points as to just how we can tie up the ceramic industry to general business. The objects of this Society and the objects of the organization which I represent are more or less the same; that is, you are all interested in the improvement of industry and the improvement of business, and we, by our studies of economic conditions, wish to help business in a general way and industries in a specific way as far as we can. I first want to discuss a few general problems and then something of a more specific nature.

American industry has developed to such an extent that an analysis of even surface conditions shows the importance of research in business.

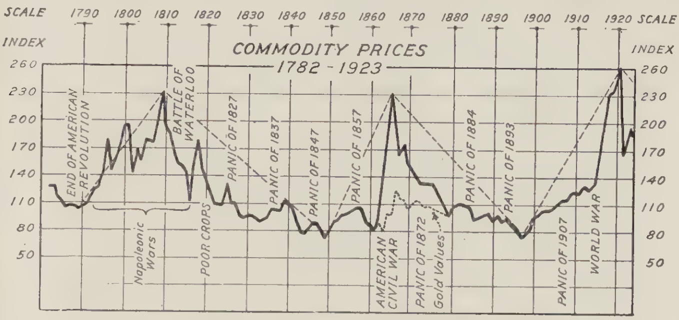


Fig. 1.

Fundamental changes during the past five years have developed numerous economic factors that indicate that business is in that stage where research is of the utmost importance.

Business is still experiencing the effects of those years of expansion and inflation, during and immediately after the war. Although many manufacturers and business men feel that we are now back to normal, you will note numerous changes during the next few years that will be directly attributable to this inflationary period.

Take, for example, the matter of commodity prices. Over a period of approximately 150 years, commodity prices have experienced three major periods of inflation and the same number of depressions (see Fig. 1). It is interesting to note that the increases started from fifteen to twenty years before the peak was reached. Each peak price was reached shortly after a war. Then followed a long period of commodity price decline usually

[1] Presented at the Atlantic City Meeting, Feb., 1924. (General Session.)

starting with a very decided reaction. We are all familiar with the trend of commodity prices since 1920. Although I do not mean to state that present business conditions are directly comparable to those following the Civil War, it is interesting to note that commodity prices have declined about the same amount since 1920 as they did during the corresponding length of time following the Civil War. Now, the indications are that the long pull trend of commodity prices is downward. Of course, we shall note various fluctuations and an upward trend from time to time such as occurred during the winter and early part of 1923. Certain economists believe that we have reached a level which will be well maintained for some time to come. No matter which group is correct, the important point is that we are not facing a long trend rising commodity market.

Such a situation as this means that certain methods of business which prevailed during the period from 1910 to 1919 will not be successful during the next four or five years. A rising commodity market favors the business man who is a speculator. A declining market favors the conservative man who studies business conditions and takes advantage of the general trend.

The rising commodity market from 1900 to 1920 had the direct effect of stimulating industrial expansion. Furthermore, war demands were such that many of our major industries became over-expanded. This factor, as you know, has seriously curtailed industrial building during the past four years. Although this handicap is being overcome in many lines, it is still a factor that must be considered in the industrial outlook. Probably the shipbuilding industry is the outstanding example of this condition.

This heavy capacity means that competition is unusually active. To meet this situation, manufacturers must keep their costs and prices low in order to maintain a good volume of sales. Without a doubt, the reduction of costs demands effective research of a technical and economic nature. The study of efficient distribution is still in its infancy and considerable research work must be done in this field by successful business men during the next few years.

The cost of production in many lines has been steadily declining. Intensive research work has been done in this field. The cost of distribution on the other hand, has been steadily increasing. It is much easier to manufacture goods at the present time than it is to dispose of them. The most successful manufacturer or distributor during the next few years will be the one who applies research work to his problem of distribution as well as the problem of production. In practically all industries, costs can be cut by better methods of distribution.

The business outlook for the rest of this year also indicates that real intensive economic research will be necessary in order to maintain a reasonable amount of profit. We are now in what might be termed "a normal

zone of business." There is little probability that we shall experience any radical fluctuations such as have been noted within the past five years. There are numerous bullish factors that might be mentioned which would indicate that the outlook for business this year is especially good. Transportation has been active and the railroads are in fairly good condition. Employment was heavy throughout the greater part of 1923, wages were high, and the spending power of the public is now good. The 1923 income of the farmers was better than in either of the two preceding years. Money rates are low. Building activity has been large and the indications are that 1924 will be another fair building year.

Offsetting these factors are certain bearish conditions. Expansion has been unusually rapid in many industries and the probability is that some of them will be forced to curtail production this year. Prices are still somewhat out of alignment. In many cases, goods are so high that buying is very conservative, with no likelihood of an improvement until lower levels are reached. Furthermore, the foreign situation is of considerable importance, especially in such lines as the ceramic industries. The general outlook for individual industries depends on the extent to which those industries are affected by the economic factors just mentioned.

Now just how do these general statements apply to the ceramic industries? Just why is it necessary for manufacturers in these lines to pay particular attention to research work? In the first place, the general trend of the ceramic industries is comparable to the broad changes in business. A direct comparison of the total value of products of the various branches of the ceramic industries with the Babsonchart clearly shows the close relationship (see Fig. 2). This chart also shows that a further readjustment in business would undoubtedly mean further changes in the ceramic industries. Consequently, the manufacturers in these lines should first pay special attention to the trend of general business in estimating what is ahead for their business.

On the basis that the long pull trend of commodity prices is downward, it is evident that ceramic manufacturers must study the methods of reducing costs or else have their profits reduced. In meeting this condition, these studies should develop along two main lines. In the first place, continued research should be made for improvement in manufacture. An analysis of these problems comes under the direction of the industrial engineer. In the second place, special attention should be paid to problems which are exterior to the immediate details of the business but which have a decided effect on the profits of the concern. These include a study of general business conditions and the factors in general business which are directly applicable to the ceramic industries. The trend of demand, prices, competition within the industry, and competition with foreign manufacturers are all of extreme importance.

A study of demand in this industry shows that the trend should be more or less continually upward. The products of the ceramic industries are of universal use and there is no reason why the total consumption should not increase at least as fast as the population. Certain lines which are directly used in building, of course, will follow the fluctuations in that industry. The long pull trend, however, should be upward. Such yearly fluctuations as will occur in demand will probably be directly attributable to and comparable with the changes in general business.

A detailed analysis of the industry shows that competition among domestic manufacturers is becoming especially keen. This industry has probably reached its saturation point and there is little doubt that capacity is more than necessary to supply a normal demand. Statistics for the clay products industry reported by the Census of Manufactures show that the number of concerns is tending to decrease. Twenty years ago, there were 5,500 establishments reporting while the value of products was given

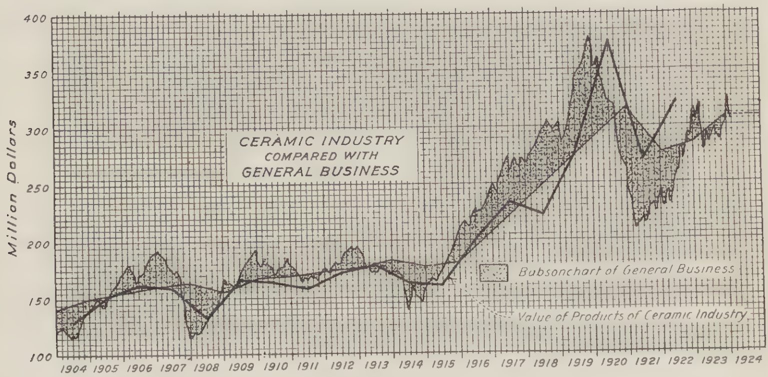


Fig. 2.

as $135,000,000. Each census year showed a decline so that in 1921 there were 2,150 establishments reporting but the value of products had increased to over $278,500,000. The number of wage-workers has decreased from 118,000 in 1904 to 97,000 in 1921. It is interesting to note that in 1909, there were approximately 133,000 workers in the industry. In 1919, there were only about 105,000.

In the various branches of the industry, we also note a decline in establishments. In 1914, there were 350 pottery concerns reporting, whereas in 1921, these had decreased to about 270. The manufacturers of brick, tile and terra cotta in 1914 numbered 3,239 and these had decreased to 1,880 in 1921. The number of workers also declined. These changes are probably due to the gradual elimination of the weaker concerns, the invention of labor-saving machinery and also foreign competition. We see no reason why the trend indicated during those years will not continue.

At the present time, probably the most important external problem in the industry is foreign competition. This factor was of importance before the war and may have been one of the principal reasons for the decrease in the number of concerns from 1900 to 1914. With the curtailment of imports during war years, the industry was materially increased. The increase in the value of products in the clay products industry during the five-year period 1909 to 1914 was from $168,800,000 to $172,800,000, an increase of only $4,000,000. In 1919, however, the value of products amounted to $283,300,000 or an increase of nearly $111,000,000 from 1914 to 1919. We realize that a certain amount of this was due to price inflation but the actual volume of products also undoubtedly showed a very heavy increase. However, throughout the five-year period, the number of concerns in the industry showed the same tendency to decrease which was noted throughout the pre-war years.

A study of import statistics shows the trend of foreign competition. Imports of clay products were decidedly restricted during the war years but since then a steady increase has been noted. In the case of pottery, for example, the value of pre-war imports amounted to approximately $10,000,000 annually. This decreased to about $5,600,000 in 1916 but since then has been steadily increasing. In 1920, the imports of pottery amounted to $10,000,000 and in 1923, the imports were well over $16,000,000. The increase has been especially noticeable in decorated chinaware and decorated earthenware. In the former case, the value of imports has increased from about $3,000,000 in 1916 to about $7,500,000 in 1923. Decorated earthenware increased in this period from $1,700,000 to nearly $4,000,000. The indications are that this upward trend will be continued despite the present tariff regulations.

Special research work will have to be done to meet this foreign competition. It is doubtful whether producers in this country can compete on labor costs with those abroad. Living conditions are different and unit wages are very much less in the principal ceramic producing countries in Europe. Consequently, it seems that the American producers must meet this situation by the production of more efficient machinery. They must also improve the present methods of distribution in the domestic and foreign markets. The indications are that the foreign producers will be able to win out on the grade of ceramic products in which labor cost is the most important factor. Manufacturers of machine-made grades should be able to build up an American market in which they will be able to compete successfully with foreign producers.

The tendency in price will be downward. Statistical data as to prices in the industry are very incomplete. However, government figures show that certain grades of chinaware are now over 125% above the pre-war level. The price index of all commodities is about 60% above the 1913

base. Advertising should be increased and should be more efficient. Special study should be made of transportation costs which is a very important factor in the industry. Furthermore, better trade information should be available. Data pertaining to the fundamental factors of the industry are very incomplete. This may be due to the complexity and variety of the products of the industry. Possibly a decided saving could be made by a better standardization of products. Many of our important industries are now devoting special research work to the elimination of unnecessary and unprofitable lines. Numerous other factors might be mentioned but the indications are that most of these would pertain to the problems of distribution.

The ceramic industries are essential to the United States and, if properly handled, should be able to successfully meet their foreign competitors. There are, however, numerous problems which must be studied. The future success of the industry depends on the solution of these questions. The best method, in fact, the only method of meeting these conditions is efficient research. This must be devoted not only to the detailed problems of production, but also to the many and complex problems of distribution. The general outlook for the industry indicates that the manufacturer who follows these lines should be prosperous and enjoy good business despite the numerous problems that are ahead.

Babson Statistical Organization
Wellesley Hills, Mass.

THE INVESTIGATION OF TERRA COTTA WORK AT THE BUREAU OF STANDARDS[1]

By Eckardt V. Eskesen

ABSTRACT

Research is being made covering failures due to popping, grazing and spalling. This work has been going on for nine years, first under the direction of Professor Bleininger, and later on under Professor Bates.

One or two fellow Ceramic Engineers have been constantly engaged in this work. Vaiious tests, such as freezing and thawing have been conducted for the purpose of testing different clay bodies and glazes submitted by the manufacturers.

I have been asked to say a few words in regard to the investigation of terra cotta work now going on at the Bureau of Standards at Washington. As I am not a ceramist myself, I will not be able to go into details or enlarge on the methods employed and the different tests conducted at the Bureau of Standards. Others present here may be able to do this much better. I can only talk about the subject in a general way and try to outline to you the benefit which our industry may in time derive from this investigation.

[1] Presented at the Atlantic City Meeting, Feb., 1924. (General Session.)

The work at the Bureau of Standards has been carried on for some eight or nine years at some expense to the Society, and at great sacrifice to the heads of the Bureau, who have in every way possible accommodated and assisted us in our work, and have given much time and study to directing this research work. I wish to say here that the Bureau of Standards is greatly interested in our problems and is enthusiastic about carrying out this research work to a final conclusion.

In every industry there are problems and troubles which are constantly popping up. Nothing is perfect. We must progress and while we are progressing we come in contact with new difficulties. New machinery and new methods have changed conditions and it is no more the old way of production.

So in the terra cotta industry—a comparatively new industry in this country. The pioneers who first opened up the road and introduced terra cotta to the American architects were not confronted with the problems which confront us today. They had other problems naturally, such as getting a suitable clay, uniformity in colors, etc.

At that period the building construction consisted of solid masonry. The terra cotta was carried in the wall on its own bond, very seldom any iron or other material being used for support. There were no failures of terra cotta then. You can go out and look at these jobs produced thirty or thirty-five years ago. Some of these buildings are still standing and the terra cotta looks as good as new, or as if it were made yesterday.

This was before the period when sky-scrapers came into being. With the sky-scraper also came into use the iron and steel construction, and later on the concrete construction; so today we have what is called modern American building construction, meaning that all the construction going on today outside of residences and small dwellings, is erected in concrete or iron and steel.

With the introduction of the sky-scraper and the concrete building, came before us the problem of how to adapt our material to the changed conditions; how to support a load of terra cotta, which now under the changed conditions, is used simply as a veneer on the front of the building, and how to hang the projecting courses, and tie down the tiers of ashlar work.

Before the period mentioned by me the range of colors put into the market by terra cotta manufacturers had been very limited. To start with in this Country the colors only consisted of red or terra cotta colors; then came a period where the cream color or fire flash colors came into use; later on nothing but gray colors were used, and with very few variations away from that rule. At this last stage of development, architects and manufacturers, seeing the desirability of getting away from the monotony of plain colors, started experimenting in glazes and colors, and a very

healthy demand was created for a wider range of colors and finishes, thereby giving new life and beauty to the modern American building in the transition from old to new methods. A period lapsed during which terra cotta, was trying to adapt itself to new conditions. Its use was greatly increased and architects, leaders in the profession, recognized the material as the one best adaptable for use in modern building construction, yet it was natural that there should, considering that the industry was itself in a state of transition, be shortcomings. It cannot be denied that there have been failures in terra cotta. We have all heard of them. Of the one hundred and one good jobs that were delivered in first class order and still stand up and are still attractive, we do not hear of; but the one bad job which failed is today an eye-sore and everybody is talking about it.

The problems which troubled us years ago are still troubling us. Conditions are constantly changing, and so today, as it was yesterday, the question is, if we must eliminate defects and failures, to adapt our material to the changed conditions. It is among others a question of proper construction; it is also an engineering question; a question of how to build so as to protect our product from the ravages of moisture and changing climate. It is also an important question for the ceramist to solve, a question of how to perfect the quality of the material, so that it will resist these climatic changes.

It would seem plausible to say that a material like ours which is burned from 1800° to 2200°F and covered with an absolutely impervious coat of glaze or semi-glaze slip, can stand up for thousands of years without changing, and so it can, if it were not for the fact that moisture through the joints or from the wall surrounding our material gets into the bond of our material and seeking the natural way of getting out again breaks through the surface, thereby causing what we call spalling and chipping, etc.

Another class of failure in terra cotta which we all well know is the breaking and chipping caused by contraction and expansion due to sudden changes in climate. We are up against a problem of adapting our material to the many varieties of severe climatic changes as we find them in the United States, where the climates range from the cold of the polar region to the heat of the tropics.

It is up to us terra cotta manufacturers to find a way of overcoming these difficulties, to solve the engineering problems, to make a material which will permit certain contractions and expansions. We must prevent moisture getting into the inside of our material and we must make our body and our glazes and slips so that they will act together. We must deliver a material which will not show cracks or crazed surfaces before or after being delivered to the building. It is with the idea of finding the proper body and the proper surface and slip, both of which will act together, that the work is now going on at the Bureau of Standards.

We are all, each for himself, constantly engaged in this work trying through our Ceramic Departments to solve these problems. But it was recognized that the question was not a question which could be entirely solved by the individual members; that considering the before-mentioned wide range of climatic conditions in the United States and considering that the manufacturers of terra cotta in the United States are scattered from east to west and are employing different methods in trying to arrive at a more perfect result, it was thought that by the investigation going on at the Bureau of Standards, the manufacturers would be able to arrive at a conclusion which could not otherwise be arrived at, or solved individually.

The work which has been going on at the Bureau of Standards consists of testing the burned material delivered by the different companies right along, and extended tests have been carried on as to the strength of the different materials, the breakage point, the porosity of the body, its coefficiency as regards the glazes. One of the tests being carried on at present consists of alternately submerging and freezing and then heating the pieces.

It is not up to the Bureau of Standards to tell us where we are right or where we are wrong. The Bureau will not be able to more than point the way, and it is up to the individual manufacturer to make his own deductions from the investigation made by the Bureau of Standards and form his own conclusions, and use the advice given him so that he may perfect his material.

There will, perhaps, never be any final result or conclusion as to the question whether a hard body is better than a soft, or a material burned to a very high degree of heat is more endurable than a somewhat lower burned material. It may be a question of the quality of the clay used, and the elasticity of the slips, either of which may be just as endurable as the other.

I have confidence, however, that the work done by the Bureau of Standards is of great value to the terra cotta industry, and that it will in the near future assist us in solving some of our problems. It is up to our ceramist from the wide knowledge gained through the investigation to make his own deductions and make same applicable in a practical way so as to fit the particular situation within his company.

New Jersey Terra Cotta Co.
New York City

REFRACTORIES QUESTION BOX

By E. E. Ayars

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire-clay brick to spalling?
2. What difference is there between the properties of a soft mud machine made and a hand made brick?
3. What is the best method of sampling fine ground fire clay for testing? Discuss straight clay and cement mixtures.
4. Can a customer form any judgment of the quality of a shipment by a test made on one brick? If not, how many samples should be used?
5. Can an iron free clay brick be made for blast furnace service?
6. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?
7. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?
8. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?
9. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?
10. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?
11. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Question

Is laboratory control possible in the manufacture of refractories?

Discussion

"Laboratory control is being practiced in the manufacture of refractories. The extent to which such control is being used varies, from plant to plant, the particular grade of product being manufactured ofttimes being the determining factor.

"Fusion and burning tests made on various strata or veins of clay make it possible to determine whether or not certain sections in a particular vein should be used in any particular product. Accordingly, as far as the control of the finished product is concerned, it is possible to use the proper selection in mining and grading of the raw materials.

"In respect to laboratory control of the actual fabrication of the raw materials in the finished product, such tests as screening, dried strength, drying and burning shrinkage, give a check on how closely the specifications of manufacture are being carried out. This question rather implies

its own answer and while laboratory tests do not insure first class product without the organization and equipment for producing it there is no question but that the industry would not have progressed as far as it has without the use of laboratory tests."—L. C. HEWITT, LaClede-Christy Clay Products Co., St. Louis, Mo.

Laboratory control of metallic alloys, and of iron and steel production, has long been so standardized and simplified that we saw great possibilities about three years ago in adapting that general procedure to the manufacture of our own "refractory alloys." In producing moderately large quantities of specially blended products there must be some controlling factor or there is danger of great variations in physical and chemical properties of the finished product. It is especially vital when there are perhaps fifteen active mixes being manufactured practically at all times, each one of these mixes differing in certain essential properties from any other mix. In order to retain satisfactorily the confidence of our customers in such products these respective physical and chemical properties must not vary beyond certain tolerances from one year's end to another. A purchaser must know that the properties which proved satisfactory a year ago will be retained within very close tolerances when he orders the same mix six months or a year afterwards.

As is known to many of us, an ultimate, or even proximate analysis of a refractory specimen is a time consuming, tiring job. Aside from the time involved and the cost of a skilled, reliable ceramic chemist the writer felt that adequate laboratory equipment and current supplies would be out of proportion to our own volume of production. There would be danger of its becoming a burden and serious delay especially since there is no point in having laboratory tests completed on production specimens after production has been practically finished. The time to draw specimens is when the blending of the mix is completed and then to devise quick, reliable and simple tests so that the laboratory report is available before that particular blend goes further into production.

It is a rather difficult task to devise, and then to set chemical tolerances without analyzing specimens thus drawn from production, but by requiring a few significant reactions on the specimen in a temperature range where its sensitiveness to chemical attack is at an approximate maximum, chemical control of production is greatly simplified and speeded up.

There is no such thing as absolute precision in the chemical or physical characteristics of any product made by Nature or man. Brief experience along the lines above suggested will set tolerances that are close enough and do not interfere with moderately large quantity production.

Laboratory control of the physical properties is so well known that it would be a waste of space to discuss it in detail. Frequently considerable

ingenuity is required in special cases, besides the routine tests for viscosity, ultimate fusion, gassing, etc., under perhaps both oxidizing and reducing conditions. As an example, it is necessary for us occasionally to determine the safe tension "fibre stresses" to which a certain finished product will be exposed. The penetrability of certain other products must be held in close control, where these products are to be exposed to various groups of fused, non-ferrous alloys, or slags, under various pressures.

Where many different components are required, such as in our own problem, laboratory control should start with the receipt of each raw component. These should be bought and accepted only on certain tolerances. Much time, labor, and grief will be saved by doing so. There are many producers who are after maximum possible tonnage of one line of product, with perhaps a "by-product" line made from inferior clays. To those manufacturers laboratory control will probably not appeal.

But to the producer of highly specialized "refractory alloys" it has proved itself not only practical after three years of operation, but in our opinion it is most essential.—T. C. Eayrs, Gen. Mgr. Massillon Stone & Fire Brick Co.

The following points on the question are taken from the discussion on the floor of the Atlantic City Meeting.

"I want to call to your attention a rather horrible example of the results of not following laboratory tests. I know of a brick manufacturer, who furnished brick for a power plant over a period of a good many years whose product seemed not to be as good as it was formerly. Upon consultation with him we found they made no chemical analysis themselves but occasionally had some made on their clay. The manager of this concern assured me the clay was of uniform quality because he showed me the analysis. I was much interested to note that sixteen years had elapsed between the tests he was discussing. It is no wonder that a good many things might happen in that time".—J. D. Carter, Philadelphia Quartz Co., Philadelphia, Pa.

"It seems to me the whole discussion has been merely on technical control of the raw materials. That is the simplest thing the refractories man has to deal with. I do not think many manufacturers today are not keeping fairly good check on raw materials. But that is only the beginning.

"We spoil the brick in the process of manufacture. When we have a poor brick it is not due to fusion but something else, due to the manufacturing process. It occurred to me that was not what the questioner wanted to know—he did not want to know whether it was a good thing to analyze the clay; he apparently is interested in the process of manu-

facture.—A. F. Greaves-Walker, Stevens, Inc., Stevens Pottery, Georgia.

"In this question of control, there is one point that might enter into the control of the production. We have a simple method of taking twenty-four bricks from each kiln and testing those for weight, size and volume. We use a simple test to do that and then we correlate that with the results of our mining trip inspections, whereby we give each month the places to work and the amount of clay taken per day from each place. In that way we can control the water content by checking the screens. Fortunately any change in the size of the screen will very soon change the water content. In dry press ware your screen size is pretty close, your water content cannot vary much and get a good brick. So we have three places in the process that we control."—(A Member.)

"It would seem that if laboratory control is to be exercised anywhere it could be exercised by the manufacturer. You can take a single clay, for instance flint clay, and establish certain standards and live up to these standards for that clay. You can take your plastic clay and build up to a certain standard there and by regular checking know how closely you come to those standards. It does not appear, however, that anyone can say just what the true control would be. Probably our mixtures are not what they should be. Perhaps we do not always hit it in the right spot in the brick—it may be that the clay is not uniform. It might be the water content, for example. Perhaps if anyone were to condemn laboratory control, it might be because of the fact that they used the wrong method. It seems to me that it is the misapplication of the test rather than the failure of the test itself."—Raymond M. Howe.

The question of laboratory control in the manufacture of Refractories, as stated, may have many applications. The Editor chooses to believe that the thought in the mind of the man who put the query should have been stated as follows: Is it possible to secure uniform quality and uniform size in refractories by the application of laboratory tests?

Within recent months the matter of uniformity has assumed a new light and all manufacturers recognize the importance of producing refractories which vary in size and quality only the smallest conceivable amount. Such production will in most cases require the further development of processes and the installation of additional equipment. It will mean added cost of manufacture but the consumer has long since indicated a willingness to pay a premium for a brick that would lay up with uniformly thin joints and give uniform service. However, many consumers will undoubtedly consider the manufacturer of uniform brick offered at a premium in the same class with the renowned Jesse James, but it is

economically impossible to give something for nothing. Uniformity in a refractory will add to the cost, but at the same time the consumer will enjoy a lower unit cost and many will take advantage of this. More and more refractories are being purchased on service instead of price only, as formerly.

It would not appear possible to regulate the uniformity of fire brick produced by the present methods, by the simple application of laboratory control methods.

The matter of fusion point and chemical analysis may be regulated in the control of the raw materials, but it is the slight variation in the character of different carloads of raw materials, and the considerable variation in process treatment from day to day which accounts for the lack of uniformity in the product.

It is taken for granted that any manufacturer considering laboratory control methods has first thoroughly prospected his mines and has plotted the different seams of clay from core drill analysis.

His attitude then in selecting his clays at the mine should be that of the man buying material on specifications, and every possible precaution be used in the mining, grading and loading to see that materials are up to a certain standard.

Given an intelligent control of chemical analysis of the raw material and the exclusion of all foreign matter it should be possible to so regulate the processes that further laboratory control was almost unnecessary.

In the February number of the *Journal* appeared a description of material handling and storage methods designed to secure uniformity in an electrical porcelain body. The system of bin storage is designed to care for from 360 to 450 tons of material while an open storage system capable of handling 1000 tons or more is described. In view of the large tonnages represented in the daily capacities of refractories plants it is probable that the open storage system would be most effective and least expensive. In choosing such a method it is important that adequate measures be taken to protect the open storage from foreign material, and all through the process dirt and such refuse as grease, etc., must be kept out of the material.

In some cases it would undoubtedly prove advantageous to put all plastic clays through a rotary drier before placing in storage.

Assuming that the matter of uniformity in the raw material is taken care of in mining and by adequate storage and handling methods, the process of grinding, screening and mixing presents a problem. Tramp iron and some iron from the mills and pans may be removed by a magnetic pulley. The screen sizes may be checked occasionally by screen analysis and erratic separations avoided by regular replacement of worn screens.

Proper grain sizes of grog and plastic clays should be determined according to behavior in service. These should be strictly adhered to and will not affect the process in any way except to indicate the type of grinding and molding treatment, *i. e.*, soft mud, stiff mud, dry press, etc.

The matter of mixing or tempering is important. It may be determined by trial whether the body is improved by double or triple milling or pugging. If the tests indicate three pug mills or additional wet grinding equipment for the preparation of one charge of brick mixture, the method should be altered to take advantage of the indicated improvement.

Moisture content is of great importance. The poidometer is used with marked success in measuring the amount of water fed to the brick mixture. In many cases they have been adjusted so delicately as to compensate for the moisture already in the clay. One of the most pregnant causes of variations in uniformity of fire brick is the hand of the "experienced" pan man or pugger on the water hydrant. The operators' judgment is never equal to the situation. Although a man may be able to produce a good column from his position at the pug mill, the limits within which a good column obtains may permit a variation of several per cent of mixing water. The writer is not convinced that the poidometer is the final answer but it is many steps ahead of the manual method.[1]

Molding methods are sometimes at fault. A variation in density and workmanship is often seen in brick produced at different hours of the day by the same hand molder. When hand molding is necessary and the clay comes to the molder in a uniform condition from time to time, it is not possible to jar the mold by some mechanical method, the effect of which has been predetermined, in order to eliminate the indifferent treatment of a tired molder.

In the case of stiff mud brick the auger speed, depth of die, die lubrication, repressing pressures and method of hacking on drier cars should be studied. The correct condition will vary with each type of clay or mixture.

Dry press pressures are variable but there is a correct pressure for each type of brick. The addition of pressure gage equipment to the dry press is indicated. Moisture of dry press mixtures should not vary and methods should be devised, in the study of grinding and mixing, to secure uniform tempering.

The determination of the cross-breaking strength on green brick will indicate the uniformity and homogeneity of the mixture. Variations in water content, grog content, size of grain and molding density may be noted. This test should be conducted on a set plan with respect to drying conditions and time.

Correct drying will have little or no effect on uniformity. Rapid drying often produces unsound brick and these are not marketable. The

[1] See "Question Box," *Bull. Amer. Ceram. Soc.*, **3** [3], 90–93 (1924).

practice of leaving hand-molded and repressed brick on the floor long enough for them to get leather hard and immediately setting them in the kiln is open to criticism. In this case most of the water that should come out in drying comes off with the water smoke. With some clays the excessive moisture during the water-smoking period softens the brick enough to change its size and shape. Such effects should be guarded against. Kilns are not efficient or satisfactory driers but there are many plants now employing this method.

Setting methods may sometimes be changed to eliminate kiln marked or misshapen brick, and thus reduce kiln losses.

Proper firing conditions should be determined and a regular schedule followed. Kilns will require redesign and rebuilding in many cases and regular repairs must be made so that proper firing conditions may be maintained. Overfiring of the ends of Newcastle kilns and of the rim of round down draft kilns may be eliminated by a study of local conditions. Some remedies may be found in the following list; redesign of kiln bottom, or fire boxes, change of coal or fuel, changes in setting method, setting farther away from bag walls (from 2 to 6 inches) admission of excess air over the fire, etc.

In conclusion, the solution of the laboratory control problem is to first refine the manufacturing processes. Laboratory methods will aid materially in determining to what extent the refinement shall be carried, and simple tests may be devised to maintain control of the new methods.

References

"Economies in the Brick Yard," Hewitt Wilson, p. 40. *Proceedings Common Brick Manufacturers Association*, February, 1924 Meeting, Los Angeles, Calif.

R. Twells, Jr., "Handling and Storage of Raw Materials to Produce Uniformity in a Body," *Jour. Amer. Ceram. Soc.*, **7** [2], 82 (1924).

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R. M. Howe

RAYMOND MILLER HOWE

The death of Raymond Howe on April 1 was a great loss not only to the many friends whose privilege it had been to know such a sterling man, but to the interests of ceramics in general. He was a specialist in refractories, but he had also broad knowledge of ceramics, and his warmly sympathetic interest in the profession and in the AMERICAN CERAMIC SOCIETY led to prominent activities on his part that will be missed generally. None, however, save the close friends who knew the rich treasures of his mind, as revealed in familiar conversation, can realize how great is the loss which ceramics has sustained in his death at the early age of thirty. For while Howe was a generous contributor to ceramic literature, there is a point of view from which it may be fairly urged that the work which rare and original minds fall short of doing because of brevity of life does never really get done at all. Something similar to it is performed, no doubt, but is done in a different order of causation; and though there may seem to be equivalence, the fact remains that, from the sum of human effort, an indefinite amount of rich and fruitful life is lost. True as this is in the case of science, it is still more obviously true in technology. Howe had an intellect that was outstanding from its happy union of acuteness with researchfulness. Very few ceramists were superior in balance of mind and in extent of literary acquirement. It is a bitter thing to lose a productive thinker of this mold, just in the prime vigor of life, and at a time when his ability was receiving recognition in industry as well as in the SOCIETY.

Raymond Miller Howe was born at Elmira, N. Y., March 15, 1894, the son of the late Mr. and Mrs. H. C. Howe. He received his preparatory education at Riverside School and the Elmira Free Academy. He was graduated at Alfred University in 1915 (B.S. in ceramics) and then came to the Department of Chemistry of the University of Pittsburgh to pursue graduate work under Prof. Alexander Silverman. He received his M.A. degree in 1916, served as instructor in chemistry for a year, and was appointed an industrial fellow of Mellon Institute in 1917. While at the Institute, 1917–23, he was senior incumbent of the Multiple Industrial Fellowship sustained by the Refractories Manufacturers Association, a position that he occupied with distinction and in which he acquired an international reputation because of his published contributions to the literature of refractories. Early in his career at Mellon Institute Howe became active in the affairs of the Robert Kennedy Duncan Club, the organization of Fellows, and in the American Chemical Society (secretary, Pittsburgh Section, 1917), and the AMERICAN CERAMIC SOCIETY (secretary, Refractories Division, 1919; trustee, 1920–1924; vice-president, 1924). He served on the advisory committee of the War Industries Board during the World War and was an interested member of the American

Society for Testing Materials and of its committee on standardization of refractories. On April 1, 1923, Howe entered the employ of the Kier Fire Brick Company, of Pittsburgh, Pa., as assistant to the president, and shortly before his fatal illness it was decided by the directorate of the company to make him a vice-president in recognition of his technical and executive value.

Howe's first research was on the silvering of mirrors. His subsequent investigations related to fire brick, refractories, and underglaze colors. A list of some thirty of his published papers is appended to this necrology. At the time of his death he had in course of preparation a comprehensive treatise on "The American Refractories Industry," collaborating with J. Spotts McDowell, of the Harbison-Walker Refractories Company, of Pittsburgh, Pa.

He is survived by his widow, Mrs. Ethel Williams Howe, and by three children, two sons, Charles and Raymond Howe, and a daughter, Catherine Howe.

The funeral took place at the home of his uncle, Charles Howe, 456 Maple Avenue, Elmira, N. Y., on April 4. The services were conducted by the Rev. Albert G. Cornwell, of the Park Church, of which the deceased was a member. Rev. Cornwell was assisted by Prof. C. F. Binns, of Alfred University. The pall bearers were Samuel M. Kier and Porter S. Kier, of the Kier Fire Brick Company; M. Grover Babcock, of the Pittsburgh Plate Glass Company; and E. Ward Tillotson, Henry A. Kohman, and Stuart M. Phelps, of Mellon Institute. Burial was in Woodlawn Cemetery, Elmira, N. Y.

E. WARD TILLOTSON

A List of the Journal Contributions of Raymond M. Howe

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"Discussion of R. J. Montgomery and S. R. Office's paper entitled 'Notes on the Laboratory Testing of Silica Brick,' " *J. Am. Ceram. Soc.*, **1**, 346–9(1918).

"Discussion of Donald W. Ross' paper entitled 'Silica Refractories,' " *J. Am. Ceram. Soc.*, **1**, 499–501(1918).

"How Slag Temperatures Affect Fire Brick," *Iron Trade Rev.*, **63**, 1288–9(1918); *Iron Age*, **103**, 255–6(1919); *Chem. Met. Eng.*, **20**, 167–8(1919); *Blast Furnace Steel Plant*, **6**, 484–5(1918); *Brick and Clay Record*, **54**, 143–4(1918).

"Tests Now in Vogue for Refractories," *Brick and Clay Record*, **53**, 1063–7(1918).

"Basic Refractories for the Open Hearth," (with J. Spotts McDowell), *Bull. Am. Inst. Min. Eng.*, **146**, 291–309(1919); discussion, *idem*, **149**, 784–6(1919); *Trans. Am. Inst. Min. Met. Eng.*, **62**, 90–112(1919); abstract, *Blast Furnace Steel Plant*, **7**, 227–9(1919).

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"Research in Refractories. Some of the Mistakes Which are Avoided by Full Use of What Science Can Tell," *Sci. Am.*, **121**, 309(1919).

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"Work of the Technical Division of the Refractories Manufacturers' Association," *J. Ind. Eng. Chem.*, **11**, 1145–6(1919).

"Year Imposes Severe Test on Refractories," *Blast Furnace Steel Plant*, **7**, 24–5 (1919).

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"Magnesite Refractories" (with J. Spotts McDowell), *J. Am. Ceram. Soc.*, **3**, 185–246(1920).

"Refractories for Electric Furnaces," *Foundry*, **48**, 911–3(1920); *Iron Trade Rev.*, **67**, 1541–3(1920); *Chem. Met. Eng.*, **23**, 1215–8(1920); abstract, *Blast Furnace Steel Plant*, **9**, 494(1921).

"Use of Fire Clay in Laying Fire-Clay Brick," *Clayworker*, **73**, 136–7(1920); *Gas J.*, **149**, 366–8(1920); *J. Am. Ceram. Soc.*, **3**, 330–1(1920).

"Vital Factors in the Testing of Fire-Clay Refractories and in the Interpretation of Results," *Proc. Am. Soc. Test. Materials*, **20**, 278–90(1920).

"Lime for Refractory Silica Brick," *Rock Products*, **24**, 37(1921).

"A Study of Spalling" (with Robert Fulton Ferguson), *J. Am. Ceram. Soc.*, **4**, 32–46(1921).

"Tests of Fire Brick Made from Ganister, Flint Clay and Plastic Clay Mixtures, with Special Reference to Spalling" (with Mark Sheppard), *J. Am. Ceram. Soc.*, **4**, 206–12(1921).

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ACTIVITIES OF THE SOCIETY

THE PRESIDENT'S PAGE

By Robert D. Landrum

The Ceramic Institute—a new idea and one very much worth while. The "virus of coöperative research is still taking."

Twenty-seven years ago a small group of men innoculated the clay-working industry with this "virus" and the result was the organization of our Society. The results of this innoculation were local at first combining for group activity those few whose education fitted them to make use of the results already obtained by scientific workers in the field of the physics and chemistry of the silicates.

Little real research in this field had been accomplished up to this time and each individual worker had a large obligation to perform. The Ceramic Schools were fostered and gradually the number of men with special training and the scientific point of view was increased. The various government bureaus were influenced to recognize the need of research in the ceramic industries and through coöperation with our society provided laboratories and there our members have gone far in their accomplishments in our field.

A long step toward increasing our usefulness was made when the scope of our activities was enlarged to include all the silicate industries. In fact this step has changed the previously accepted definition of the word "ceramic." Next came the movement which gave us our full time executive secretary and his very efficient associates.

And now comes this new idea—The Ceramic Institute. The idea has sprung from several different sources and under as many different names, but in each case it has originated in a trade association. Each time from a group of men associated for commercial purposes. This means much.

Here is our opportunity to again increase our field of usefulness. You members of the American Ceramic Society who are in these associations know that by acting with us they can save duplication. Advise them of this fact. They can employ a "going" organization. An organization with a world-wide prestige of wonderful things accomplished. For twenty-seven years American ceramists have collaborated in the American Ceramic Society through our conventions and publications and established a record of which all may well be proud.

The American Ceramic Society members are loyally determined that their organization shall be and do things productive of the greatest benefit to all who will labor with them. There has been no hesitancy in changing procedure or direction of activities when such was thought to be beneficial and there would be no hesitancy now to so alter our affairs that the Ceramic Institute could be brought into active being.

Our Society is incorporated under the laws of the State of Ohio; it has a Constitution and a form of organization to which there is rigid adherence. These bespeak solidarity and orderliness in purpose. We do not represent the prejudices or special purposes of any person or group of persons.

Our Society is unique in that it is devoted *exclusively* to the promotion of the technical, scientific and artistic advancement of the Ceramic Industries. Questions of trade, tariff and traffic are not within its scope. We are here to promote scientific research, to assist and guide all desiring our assistance or leadership.

Our Society is unique also in that it represents the interests of all ceramic groups and agencies, each and every Silicate Industry, the colleges, the federal bureaus, the suppliers of materials and equipment and the Trade Press. Of course, while rights of each group are equal, the benefits are in proportion to their representation and activity. The essential thought I want to bring out is that if the several trade associations will get together in the support of a Ceramic Institute for the purpose of centralizing and planning coöperative research, they would do well to consider using our editorial and

committee organization. Our SOCIETY, a successful, going organization is theirs if they will but use it.

We are growing in strength and in service but feel that as yet we have hardly started. This is a plea, against duplication of effort and expenditure by the trade associations, and for a broader field of service for us.

The SOCIETY was intended to be, and is anxious to be in the largest way a collaboration of all ceramic groups. It requires nothing but the determination of the ceramic trade associations to make the SOCIETY include all that they have in mind that the Ceramic Institute shall be.

I am writing this in Boston where I have spent the day with Dr. Stratton, President of the Mass. Inst. of Technology. Next month perhaps I can tell you how this great University of Science and Technology is planning to coöperate for greater service to the Ceramic Industries.

MEMBERSHIP WORKERS' RECORD

This is the "flux" season in memberships; some have engaged in fields other than ceramics; some have not felt the urge to send in their subscription fee and yet others have changed their status from personal to corporation representative. We mourn the loss of five by death.

May 1 is the time of physical inventory of members and the dropping of the "no response" group; "pruning to the quick," leaving only the vigorous growth. This job is detested but the results in time are pleasing.

This letter from M. E. Manson of Rundle Mfg. Co., is typical of several received recently. They tell in very plain words of a growing industrial appreciation of collaboration in research and education.

"The time has now come when my Company feels that it should have a corporation membership in the AMERICAN CERAMIC SOCIETY. At the same time I wish to keep my personal membership."

Here are the March workers and the fruits of their labor:

	Personal	Corporation		Personal	Corporation
G. Percy Cole	1		C. H. Lawson	1	
M. R. Cuthbertson	1		M. E. Manson		1
Robert F. Ferguson		1	Frank G. Roberts	1	
M. L. Hartman	1		John Sawyer	1	
F. A. Harvey	1		Mary G. Sheerer	1	
S. C. Hemsteger		1	Eric B. Turner	1	
H. A. Huisken	1		Robt. Twells, Jr.	1	
Everett C. Hunting	1		Hewitt Wilson	2	
F. G. Jaeger	1		Office	16	
W. F. Landers, Jr.	1			—	—
R. D. Landrum	3		Total	35	3

	Personal	Corporation	Totals
Net Roster, March 14	1992	299	2291
Acquisitions to April 15	35	3	
	2027	302	
Withdrawals	2	2	
Deaths	5		
Net Roster, April 14	2020	300	2320

NEW MEMBERS RECEIVED FROM MARCH 15 TO APRIL 15

PERSONAL

Allan, John Caldwell, 263 St. James St., Montreal, Canada. Mining Engineer.

Alleman, Fred Franklin, 2940 Harding Ave., Detroit, Mich. Dressler Kiln Operator, Champion Porcelain Co.

Baddeley, Frank, 206 E. California St., Walnut Park, Glendale, Cal. Instructor in Ceramics, Lincoln High School.

Barber, Lyman F., Sales Engineer, Southwestern Engineering Corp., 12th Floor, Hollingsworth Bldg., Los Angeles, Cal.

Bedson, Will, Lawrence Road, R. F. D. 4, Trenton, N. J. General Manager, Elite Pottery Co.

Breneman, John C., Builder and Installer of Furnaces, Bowley Lane and Philadelphia Rd., Baltimore, Md.

Broomall, Grant C., Director of Service Engineering, The American Rolling Mill Co., Middletown, Ohio

Clark, Roland J., Student, N. Y. State School of Ceramics, Box 92, Alfred, N. Y.

Curtis, Edmund de Forest, Wayne, Pa., Proprietor Conestoga Pottery, Instructor Pottery, Penna. Museum and School of Industrial Art, Philadelphia, Pa.

Darby, Geo. M., Research Engineer, The Dorr Co., Westport, Conn.

Dorst, Max, Maschinenfabrik vorm Georg Dorst A.-G. Sonnenberg-Oberlind (Thür), Germany.

Easter, George J., 634 Elmwood Ave., Niagara Falls, N. Y., Assistant Director of Research, The Carborundum Co.

Eigenbrot, Edwin A., 3500 N. 2nd St., St. Louis, Mo. Supt. Enamel Dept., The Bucks Stove and Range Co.

Farnsworth, Richard M., Harvard St., Lancaster, Mass. Miner of Fuller's earth.

Fosseen, A. B., President and General Manager, Washington Brick, Lime and S. P. Co., Spokane, Wash.

Grady, R. F., Jr., 24 W. Frambes Ave., Columbus, Ohio. Student, Ohio State University.

Harcourt, Harry E., 805 Bank of Hamilton, Toronto, Canada. Manager, Industrial Minerals Corp. of Canada, Ltd.

Huot, Constant John, 7353 Denniston Ave., Swissvale, Pa. Glass Chemist, Pittsburgh Lamp Brass & Glass Co.

Kennedy, F. J., 150 Nassau Street, New York City, Gen. Mgr., West Gas Improvement Co. of America, Inc.

Lacy, Roy, 634 S. St. Andrews Pl., Los Angeles, Cal. Assistant General Manager, Pacific Clay Products, Inc.

Leming, Frank, LaOroya, Peru, South America. Cerro de Pasco Copper Corp.

Lowrance, R. E., Beaver Falls Art Tile Co., Beaver Falls, Pa.

Martin, Geoffrey, Rosherville Court, Burch Rd., Graves Eng, Kent, England. Director of Research of Brit. Portland Cement Research Association.

McGrath, Leigh John, Civil Engineer, 1540 S. Walnut St., Casper, Wyoming.

Moran, J. J., 610 Ward St., Vineland, N. J. Assistant Chemist, Kimble Glass Co.

Perham, Alfred C., West Paris, Me., Owner of Quarries.

Pollard, J. A., 503 Union and Planters Bank Bldg., Memphis, Tenn.

Reese, Lemuel V., 813 Cross Ave., Elizabeth, N. J. Chief Engineer, U. S. Metals Refining Co., Carteret, N. J.

Schneider, N. L., District Representative, United Alloy Steel Corp., 614 Swetland Bldg., Cleveland, Ohio.

Sloteman, Ambrose M., 27 S. Fairview St., Lock Haven, Pa. Salesman, Crescent Refractories Co.

Smith, Wm. H., General Manager, Franklin Porcelain Co., Box 83, Norristown, Pa.

Straumford, Joe Franklin, 762 Savier St., Portland, Ore. Asst. Supt., Portland Plant, Denny-Renton Clay & Coal Co.

Sutterlin, Frederick, Supt. Maddock Pottery, Trenton, N. J.

Tobitt, F. A., Sales Dept., The American Rolling Mill Co., Middletown, Ohio.

Van Gelderen, F. M., Enschede, Holsland.

CORPORATION

Garfield Fire Clay Co., Robinson, Ind. Co., Pa. Manufacturers of Refractories, F. E. Robinson, Treas.

Mt. Clemens Pottery Co., Mt. Clemens, Mich. Semi Porcelain Dinnerware, Chas. E. Doll, Treas. & General Manager.

Rundle Mfg. Co., Milwaukee, Wis., Enameled Sanitary Ware, Albert C. Held, Sec.

PERSONAL NOTES OF MEMBERS

Donald B. Atwell has notified the Secretary's office that his present address is 4921 Page Boulevard, St. Louis, Mo.

C. P. Blatchley, until lately of Manor Park House, Worksop-Notts, England, is now living at Parkfield. Mr. Blatchley is manager of the Steetley Lime Co., Ltd.

Oscar Brewer, who has been connected with the Leeds and Northrup Co., of Philadelphia as Sales Engineer, has been placed in charge of the office recently opened by that Company in Cleveland, 1217 Union Trust Bldg.

Emil Bronlund has moved from Alberta, Canada, to Seattle, Wash., 3909 E. Howell Street.

Herman Coors is now living at 5469 Ninth Ave., Los Angeles, Calif.

Arthur De Vol gives as his address 964 Brighton Blvd., Zanesville, Ohio.

Richard D. Ferguson has moved from Lincoln, Nebr., to 1018 Wells St., Apt. 49, Milwaukee, Wis.

Robert F. Ferguson, Secretary of the Refractories Division is located in Bolivar, Pa., Box 74.

R. B. Gilmore of Cleveland recently became affiliated with the Carborundum Co., and is living at 521 Jefferson Ave., Niagara Falls, N. Y.

R. P. Herrold of the Mosaic Tile Co., Zanesville, Ohio, has been appointed representative for the Company's corporation membership in this Society.

Z. C. Kline of the General Electric Co., has been transferred from the Rhode Island Glass Division of that Company at Central Falls, R. I., to the Niles Glass Division, Niles, Ohio.

T. A. Klinefelter is now associated with the Hercules Porcelain Co., Box 124, Belvidere, Illinois.

S. Y. Liu, formerly of Boston, Mass., is now employed as engineer for the Chen Kwong Ceramics Co., Hong Kong, China. His address is % Lai Sang Choung, 297 Queen's Road.

H. S. Magid is located at 103 Perry street, Tiffin, Ohio. He is employed with the Standard Porcelain Mfg. Co., Tiffin Works.

Frank B. Mahoney is employed as superintendent of the Enamelware Division, the Humphryes Manufacturing Co., Mansfield, Ohio. Mr. Mahoney's home was formerly in Chattanooga, Tenn.

Crawford Massey is with the West Coast Plant of the American Encaustic Tiling Co., and his address is 492 E. 46th St., Los Angeles, Calif.

Louis Navias, in the past year a special expert in the Ceramic Division of the U. S. Tariff Commission has joined the Research Staff of the General Electric Co., Schenectady, N. Y., as ceramic chemist.

Carl Perg has moved from Des Plaines, Ill., to 609 W. Kalamazoo Ave., Kalamazoo, Mich.

Robert D. Pike has written that his new address is 582 Market St., San Francisco, Calif.

W. H. Powell has requested that his mailing address be changed from 350 Madison Ave., N. Y., to 41 Plymouth St., Montclair, N. J.

E. E. Pressler has concluded his work with the Bureau of Mines, Ceramic Experiment Station, Columbus, Ohio, and has left for his home in Tosca, Texas.

P. B. Richardson, representative of the Harbison-Walker Refractories Co., has notified the Secretary's office that his correct mailing address is 200 Devonshire St., Boston, Mass.

Wallace C. Riddell, of Berkeley, Calif., has changed his address from 2544 Buena Vista Way to 1960 El Dorado Ave.

Robert Roadhouse, formerly of Norwalk, Ohio, has moved to Clyde, Ohio.

Drew M. Thorpe, formerly of Pittsburgh, Pa., is at present employed in the Buffalo, N. Y., office of the General Refractories Co.

L. A. Vincent will soon leave Tottenville, S. I., N. Y., and can be addressed at Box 243, New Castle, Pa.

S. Paul Ward has recently moved from McGill, Nevada, to 1200 Oak Grove Ave., Los Angeles, Calif.

Eugenie A. Worman, who has been teaching pottery at the University of Washington, has moved to 4809 Beach Drive, Seattle.

RESOLUTIONS ON THE DEATH OF MR. BUCK

February 14, 1924.

At a meeting held in Atlantic City on February 5, the Enamel Division of the American Ceramic Society took the following action: The Chairman of the meeting, Mr. H. F. Staley, called attention to the sudden death of one of our fellow members, and motion was made of the contribution of a scientific nature made by Mr. Daniel M. Buck.

A committee was named to draw up a resolution. This committee consisted of

Mr. R. D. Wells, Floyd-Wells Company, Royersford, Pennsylvania,

Mr. Emerson P. Poste, Elyria Enameled Products Company, Elyria, Ohio,

Mr. J. A. Aupperle, The American Rolling Mill Company, Middletown, Ohio.

Resolved: That the Enamel Division of the American Ceramic Society desires to record its feeling of deep regret at the untimely death of one of its members and coworkers, Daniel M. Buck, Metallurgist for the American Sheet and Tin Plate Company.

Resolved: That the American Ceramic Society express its appreciation of the scientific contributions made by Mr. Buck and their influence on the study of special problems which engaged his efforts. Therefore be it further

Resolved: That this expression of the appreciation of his wisdom and impartial coöperation in the work on enamel problems be published in the bulletin of the American Ceramic Society; and be it also further

RESOLVED: That a copy of this resolution be sent to Mrs. Daniel M. Buck, 6945 Meade Street, Pittsburgh, Pennsylvania, and to Mr. Eugene W. Pargny, President of the American Sheet and Tin Plate Company, Frick Building, Pittsburgh, Pennsylvania.

NECROLOGY

John Betteley and John Cuffin

Word has been received of the deaths of John Betteley of Ferndale, Mich., on March 28, 1924, and also of John Cuffin of Portland, Ore. Mr. Cuffin died very suddenly July 13, 1923, but word of his death has only now reached the office of the Secretary.

LOCAL SECTION NOTES

Pittsburgh Section.—The officers of the Pittsburgh Section of the American Chemical Society held a joint meeting with the Pittsburgh AMERICAN CERAMIC SOCIETY on April 17 at the Pittsburgh Station, U. S. Bureau of Mines. The motion picture "The Story of Refractories" was presented. "The Manufacture of Refractories" was presented by J. Spotts McDowell. McDonald C. Booze talked on "The Testing of Refractories." An open discussion was held on "The Application of Refractories."

St. Louis Section.—The St. Louis Local Section of the Society held a meeting on April 22. Particulars of this meeting will be given in the next issue of the *Bulletin.*

REPORT ON PATCHING CEMENTS

BY C. W. HILL[1]

Following the St. Louis meeting, a committee was appointed to investigate Patching Cements. Information was received from nearly all the Terra Cotta Companies regarding the cements in use. The field was divided among the members of the committee and a uniform method of testing agreed upon. This also provided for a certain amount of duplication among the workers to give a check on the results of the individual. Test pieces were made.

The actual experimentation was not promptly carried out, the reason being given that the workers were too busy to do the work. Two of the committee later changed their connections, and were unable to do any work.

Some work was done by W. L. Howat and assistants on the commercial cements. The preliminary results indicated that cements of the basic phosphate type are better suited than some of the commercial cements on the market. Further investigation would include a study of the best compositions of this type of cement and correlation of these results with those on the dental cements with which it is allied. It has been impossible for over a year to revive this work.

The committee has but little to add to the common knowledge of this subject. It was clearly indicated by the original replies that at that time none of the companies had investigated the subject thoroughly. The tests reported thus far indicate a wide variation in the value of various cements in use, some of those being of poor quality.

On account of the incompleteness of the results, and the consequent danger of incorrect conclusions, this report is made without experimental data.

[1] Chairman of Committee.

It is clearly a field which should be investigated. Our experience would indicate the extreme difficulty if not impossibility of investigating the subject properly and in a reasonable time by means of individual ceramists working in coöperation. Apparently few of the companies have a large enough staff of ceramists to be able to assign a man to work on the problem intensively.

While the problem could be cleared up by one man in a fairly short time, it is one in which all companies are interested. The suggestion has, therefore, been made to the National Terra Cotta Society that they consider referring the problem to the Bureau of Standards to be handled at the same time with other investigations now under way.

MANY INVITATIONS RECEIVED

Western Manufacturers Eager to Entertain

The following firms of the western coast have extended to those members of the SOCIETY who will attend the Pacific Coast Meeting the cordiality of their welcome. Members of the East and Mid-west are assured of the finest trip both in scenic value and of interest to technical ceramists that the SOCIETY has ever sponsored. The dates are July 21 to August 20.

Henry Weiss, West Coast Porcelain Mfrs., Millbrae, Calif.
H. C. Elliott, Pres. Cascade China Company, Portland, Oregon.
H. R. Kreitzer, Secy., Columbia Brick Works, Portland, Oregon.
J. B. Watson, Mgr., Idaho Fire Brick Company, Troy, Idaho.
Carl F. Kneisel, Secy., Sheridan Press Brick & Tile Co., Sheridan, Wyoming.
R. M. Bard, Asst. Mgr., American Fire Brick Co., Spokane, Wash.
Paul S. MacMichael, Pres. Northern Clay Company, Auburn, Wash.
L. R. Burdick, James Graham Mfg. Company, Newark, California.
A. J. Gladding, Gladding, McBean & Company, San Francisco, Cal.
John T. Roberts, Mgr., Stockton Fire Brick Co., San Francisco, Cal.
F. A. Costello, Pres., California Pottery Co., San Francisco, Cal.
N. W. Stern, Pacific Sanitary Mfg. Co., San Francisco, Cal.
R. B. Keeler, California Clay Products Co., South Gate, Cal.
Findlay M. Drummond, Alberhill Coal & Clay Co., Los Angeles, Cal.
H. B. Potter, Secy., Los Angeles Pressed Brick Co., Los Angeles, Calif.
H. S. Thatcher, Gen. Mgr., Celite Products Co., Los Angeles, Calif.
R. B. Ahlswede, Secy., California Metal Enameling Co., Los Angeles, Calif.
F. B. Ortman, Vice-Pres., Tropico Potteries, Inc., Glendale, Calif.
Earnest H. Batchelder, Batchelder-Wilson Co., Los Angeles, Calif.
Fred H. Robertson, Claycraft Potteries, Los Angeles, Calif.
C. D. Gram, Vice-President, Vitrefrax Company, Los Angeles, Calif.
W. G. Brady, Secy., Pacific Clay Products, Inc., Los Angeles, Cal.

George P. Fackt, Northwestern Terra Cotta Co., Denver Division, has extended in the name of the Colorado members a welcome to Denver and Colorado Springs, to their ceramic plants and their social facilities.

A great trip from Chicago to Spokane, Seattle, Portland, San Francisco, Lincoln Los Angeles, Denver, Colorado Springs, and return. A personally conducted tour, hotels and all conveniences arranged, a splendid mixture of sight seeing, social intercourse, plant visit and technical meetings that will not for a long while be surpassed. Our Western members guarantee these and the facilities are provided.

NOTES AND NEWS

BUREAU OF STANDARDS

Opportunity for Ceramists

The National Bureau of Standards, which is continually being called upon more and more to investigate problems in the interests of American industrial development, is at this time offering unusual inducements to young men who wish to avail themselves of the opportunity of training in investigational work. This is particularly true of the Ceramic Division. This Division has for many years supplied the industry, in a large measure, with technically trained men, and the demand made upon it has been so great as to exceed the supply. There are at this time several openings, offering exceptional opportunities for men interested in all ceramic lines, more especially whiteware, both for graduates and for men who have had one or more year's experience in the field. Applications should be filed through the Director, Bureau of Standards, Washington, D. C.

Increasing the Strength of Lime Blocks

Previous work by the Bureau indicated that when cast lime blocks have the same distribution of core space as gypsum blocks they will have about the same weight but less strength. It has been found that by changing the design of a block so that the total volume of core space is the same but is contained in two elliptic cores instead of four circular cores the strength of the block can be increased sufficiently to meet the requirements now put upon gypsum blocks. This work has been conducted in coöperation with the National Lime Association and a final report on the matter has been transmitted to that organization.

Recommended Specifications for Ceramic Whiting

Circular No. 152 of the Bureau of Standards, obtainable from the Superintendent of Documents, at 5 cents a copy consists of the fifth of a series of specifications for the kinds of lime required by different chemical industries. The preceding four dealt, respectively, with lime used in cooking rags, in causticizing, and in the manufacture of sulphite pulp and glass. This deals with lime used in making glazes, enamels, and similar ceramic products. Ceramic whiting is really calcium carbonate, with or without a small amount of magnesium carbonate, but it performs the function of lime. It should contain not less than 97 per cent of carbonates, and should be very fine, so that 98 percent of it will pass a No. 200 screen.

Recommended Specifications for Quicklime and Hydrated Lime for the Manufacture of Sand-Lime Brick

Circular No. 150 of the Bureau of Standards, copies of which may be obtained from the Superintendent of Documents at 5 cents a piece, covers the sixth of a series of specifications for the lime used in various chemical industries. To assist in the development of these specifications, the Bureau has called together an Interdepartmental Conference on Chemical Lime, composed of representatives of the Geological Survey and Bureau of Mines of the Interior Department; the Bureau of Soils, Bureau of Chemistry, Forest Service, and Fixed Nitrogen Research Laboratory of the Department of Agriculture; and the Chemical Warfare Service of the War Department. The present specification, based on a draft originally prepared by W. E. E mley, of the lime section, Bureau of Standards, has been unanimously approved by the above conference and by the National Lime Association.

Either quicklime or hydrated lime may be purchased for making sand-lime brick, but the former must be completely hydrated before it can be used. Material of about 85 percent purity and reasonably low in magnesia is required. The lime must also be reasonably fresh, as indicated by a low content of carbon dioxide. Methods of analysis are given in detail.

Recommended Specification for Quicklime and Hydrated Lime for the Manufacture of Silica Brick

Bureau of Standards Circular No. 153 covers recommended specifications for quicklime and hydrated lime for the manufacture of silica brick. A brief description of the way in which lime is used for this purpose is followed by a general statement as to the quality of lime required.

The standard of quality is set at 92 percent based on the non-volatile matter, with maximum limits of 5 and 10 percent carbon dioxide, depending upon whether the sample is taken at point of shipment or of destination.

Complete directions for sampling and testing are included. Copies may be obtained at 5 cents a piece from the Superintendent of Documents.

Equalizer Apparatus for Transverse Tests of Bricks

In Technical News Bulletin No. 79, Item 20, brief mention was made of the apparatus designed by H. L. Whittemore for the transverse testing of bricks.

A description of this apparatus is now available in printed form as Technologic Paper No. 251 of the Bureau of Standards, copies of which may be obtained from the Superintendent of Documents at 10 cents a piece.

The new equalizer apparatus consists of two equal arm levers about the length of the brick, mounted side by side on a pin at the middle of their length. At each end the levers have barrel-shaped knife edges carried on vertical spring-steel plates, which allow longitudinal movement of the knife edges. The levers equalize the four forces acting upward on the lower surface of the brick. The upper knife edge and the bearing plate are self adjusting.

Refractories for Boiler Settings

At a recent conference of the committee on refractories of the Federal Specifications Board the tentative specifications for boiler setting refractories were revised to meet the suggestions submitted by the industry and by the various Government departments since their promulgation as "tentative." The specifications as revised will be submitted to the Federal Specifications Board. At the conference it was further decided to take up the preparation of specifications for fire clay used as a mortar and for the so-called "plastic" refractories used in building rammed-up boiler linings.

Experiments with Glass House Refractories

As mentioned in Item 4 of Bulletin No. 83 the Bureau has been carrying out some experiments on the composition and method of making the "cut offs" used in controlling the flow of glass to automatic bottle machines. During the month one complete set of these "cut offs" consisting of 25 shapes has been cast. For this work a mixture of clay and grog that has been found to be resistant to glass attack and spalling was used. Four additional shapes of a second set, the body composition of which is somewhat different as to grog sizing as well as grog-feldspar content, have also been cast. The ten shapes reported as cast during the last month have been burned. A plaster mold has been completed for casting "flow spouts" which are used in connection with the cut offs," the proper specific gravity for the slip in this process has been determined, and six of these shapes have been cast. The same bodies used in the manufacture of the "cut offs" are being used in making up the "flow spouts."

The Abrasive Hardness of Ceramic Glazes

The glazes on six brands of vitreous ware and two glazes prepared at the Bureau were tested for abrasive hardness during the past month. The two Bureau glazes, although of typical composition, showed much greater abrasive hardness than any of the glazes on commercial ware and somewhat greater hardness than porcelain glazes. The hard glazes were found to be comparatively thin and yet they were as satisfactory in appearance as the thicker ones. It therefore appears that thick-

ness may have an important bearing on the hardness of ordinary commercial glazes and this phase of the problem will be given further study.

The Thermal Dilation of Ceramic Materials Scientific Paper No. 485, which may be obtained from the Superintendent of Documents at 5 cents a copy, describes an interference method and apparatus for measuring the thermal expansion of ceramic materials. The samples, in the form of small pins, 0.5 to 10.0 mm. in length, are placed between two fused quartz interferometer plates and heated in an electric furnace. The elongation of the samples is determined from the number of interference fringes that pass reference marks on the interferometer plate while the sample is being heated. A change in length of the sample of one-millionth of an inch can be easily detected. In order to show the application of this method to the study of the expansion of ceramic materials, measurements were made on several samples of glaze, terra cotta, tile, porcelain, and clay in the temperature interval 20° to 1000°C. Some of the samples were especially prepared, while others were taken from finished products, some of which had failed in service.

BUREAU OF MINES NOTES

Research Fellowships Offered Starting with the school year, October 1, 1923, three fellowships were initiated at Ohio State University as a result of a coöperation between the U. S. Bureau of Mines and The Engineering Experiment Station of Ohio State University. The fellowships, which carry a stipend of $750, are for the purpose of securing data in the ceramic field. The investigations are carried on in the laboratories of the Bureau of Mines and are jointly directed by the staff of the Bureau and the head of the college department in whose field the particular research falls. During the past year the following problems were investigated:

1. The cause of volume changes in fire brick during heat treatment.
2. Dolomite investigation No. 3 (binders and method of fabrications).
3. Utilization of pebbly clays for heavy clay products manufacture.

These fellowships for the coming school year will be filled about May fifteenth. More detailed information can be obtained in regard to the character of the work or in regard to the qualifications required of an applicant, by addressing an inquiry to either: Dean E. A. Hitchcock, Director, Engineering Experiment Station, Ohio State University, or G. A. Bole, Superintendent, U. S. Bureau of Mines Experiment Station.

Higher Salaries for Ceramic Engineers The United States Civil Service has recently advertised an examination open to ceramic engineers for government service, the salary ranging from $3800 to $5000. These salaries are considerably higher than any hitherto offered for a similar opening in government service, and hence should attract experienced engineers in the ceramic industry.

COLLOID SYMPOSIUM AT NORTHWESTERN UNIVERSITY

Ceramic Papers Scheduled Members of the American Ceramic Society will be interested in the announcement of the program of the Colloid Symposium to be held at Northwestern University, June 19, 20, and 21. Among the speakers appearing on the program are the following, whose subjects will be of interest to ceramists.

A. V. Bleininger, "Properties of Clays."

Eugene Bingham, "Fluidity and Plasticity in Colloid Control."

Jerome Alexander, "Bentonite and Other Colloidal Clays."

W. J. Kelly, "The Determination of Size of Particles and Their Control."

F. P. Hall, "The Effect of Hydrogen-Ion Concentration on Clay Particles."

There are other important papers on the program, but the above are of especial concern to ceramists.

NATIONAL LIME ASSOCIATION MEETING

The National Lime Association will meet on May 20, 21, 22, 23 at the Greenbrier Hotel, White Sulphur Springs, West Virginia. The program will include not only a report of the activities of the Association, but there will also be scheduled certain special features, such as a Golf Tournament.

COMMON BRICK MANUFACTURERS ASSOCIATION CONSIDERS PROPOSAL OF A CERAMIC INSTITUTE[1]

The cement industry has a concrete Institute, which functions to disseminate authoritative data on concrete, and whose findings are given greater prestige than if issued by the Portland Cement Association and are listened to with greater respects by architects, engineers, Government departments, and the public.

A Clay Products Institute can be organized to speak in the same way for this industry, face brick, hollow tile, drain tile, flue linings and sewer pipe, refractories and pottery, at no greater cost at the start than that required for a desk, letter heads, and the salary of a director.

The Concrete Institute appears to be in close touch with Lewis Institute, a concrete testing laboratory run under the able direction of Prof. Abrams.

We do not propose to build a laboratory. Instead, the director would correlate the work of the research departments of the Universities, the Government Departments and other testing agencies supported already by the taxes every brick man pays.

The present Ceramic Society has offered to act as the nucleus of the proposed Institute, and it might be easier to get such an Institute started and sold to the other industries by making use of the present organization and facilities of the Ceramic Society.

Any tests desired would be asked for by the Clay Products Institute. The representatives of the various industries within the Institute would, of course, supervise all tests as at present, but the results would be published with the prestige of the Clay Products Institute behind them.

Not only technical data, but non-technical information of interest to the average man might be issued by the Institute also.

The entire cost for the first year should not exceed $7,500 to $10,000; and this overhead should be borne by the Associations supporting the Institute. The cost of any testing work would be paid for by the Association or the member who ordered such work done—exactly as is the case at present.

The second proposal, entirely distinct from the first, is this:

Mr. Stoddard and Mr. Bowen, in going around the country, have found that there is a distinct need for some testing laboratory, where clays can be tested. If a manu-

[1] From report of Proceedings of Sixth Annual Convention.

facturer is not entirely satisfied with the product he is getting from his clay, he wants to know why; or, if his clay bank is exhausted and he wants to continue in business in the same locality, naturally he wants to locate some other source of supply of his material.

It seems that there is quite a strong demand for a laboratory of this kind, and I am very pleased to offer to you this suggestion for the running of a laboratory now established.

Proposal for the Running of an Experimental Brick Plant

There is a practical stiff mud brick plant now lying idle in one of the buildings at Ohio State University at Columbus, designed by Col. Orton.

It is proposed that the U. S. Bureau of Mines, Ohio State University and this Association coöperate and run this plant to test clay in a practical manner.

Plant Cost: The plant cost originally about $11,250. It never has been run. It would need a little changing and additional equipment to put into actual operation. The University would pay part of such additional cost and we would pay part. Our part is estimated by Mr. Bole, Supt. of the Ceramic Station of the Bureau, at $2250.

Operating Cost: Cost of operation would be borne partly by us and partly by Bureau of Mines. Based on full time operation of plant (about 12 to 14 kilns per year) this would be about as follows. (Bureau of Mines estimate.)

	Our expenses	Bureau and University expenses
Fuel	$1000.00	
Repairs and Upkeep	1000.00	
Cartage of clay	1200.00	
Power, light and heat		$ 650.00
Superintendent, at $3500	1000.00	2500.00
Junior engineer		1800.00
Labor	1500.00	
	$5700.00	$4950.00

In addition, all overhead is borne by U. S. Bureau of Mines.

Ceramic Experts Available: The entire facilities of the Bureau of Mines Experiment Station and the Ceramic Department of Ohio State University would be available for consultation without charge. Personnel includes ceramic engineer, chemists and petrographer. Bureau has complete ceramic laboratories fully equipped.

Mr. Simons: I want to lay this before the members and directors for consideration. It is in reference to raising funds to continue the activity of your national association, and take up just such things as have just been presented, and I would like you to take it into consideration. I don't ask for any action at this convention, but I would like to have you think about it.

We find that we are getting great returns in this state and expect, from the amount of money we are putting into it, and hope, that we will have demonstrated in the course of a year or so, that we can even grow double the amount.

The law of compensation is that you only get out what you put in. You have to give in order to get, so under that policy, we are satisfied here, and I wish the members of this organization would consider it possibly at another meeting, or the board of directors would take it under consideration, and ask for a referendum on it, to the members, so that we might get action.

I don't believe that the Association should go into any proposition where we sustain a laboratory at this time, because we are short of funds. If men want to have their clays examined or anything of that kind they should be willing to pay for it.

There are too many men going into the brick business who are not qualified to be in. They should learn something first. A good way is to get up early and go out to the plant and work hard. Don't believe a lot of things a lot of promoters who come along try to tell you what clay will do. It isn't so hard, if you are a little bit patient and go down to the foundation of the business and work along with it, to find out for yourselves.

Mr. F. T. Houlahan: (Seattle, Wash.) If I may I would like to differ with my good friend, Mr. Simons. I think I have a good reason to differ with him. Not so very long ago our association mailed out to the different members and the other trade associations did the same thing, a report of a committee of some sort or other, that went into the burning problem. We got this report because of our membership in the association.

We have reduced our burning time and saved money in burning, and I would like to make a motion at this time that this association go on record as favoring coöperation with the Bureau of Mines.

Mr. Schlake: I am not going to oppose that motion, although I am not satisfied in my mind that we are right to go along with it or as favoring something that might require the expenditure of a considerable sum of money. I believe that any undertaking along those lines is going to pay when the proper time comes. I would suggest that instead of taking action here, where it is going to be impossible to weigh all the arguments pro and con, that the matter be referred to the Board of Directors. I have no objection to coupling this up as an amendment to the motion that the convention feels that this subject is well worthy of consideration, and hope for favorable action.

Mr. Houlahan: Under those circumstances I will withdraw my motion. I think probably it is better that the board should act on it, but I feel very deeply on this subject. We have a Bureau at the University of Washington and it has done all the clay workers around that section a lot of good where we have taken advantage of it, and I think wherever the clay worker can work in harmony with the technical man he should do so. Understand, I am not a technical man, and up until a year or two ago I thought a technical man was the "bunk"—but there is merit in them; some of them at least, and they have good horse sense. They are doing mighty fine work and I am for that right down the line.

Mr. Stephenson: Last year a communication came to my plant. One of my boys is in charge of it, and he hadn't very much experience in burning brick and did not have that to do—he was in general charge of the plant, that was all. This came from the Common Brick Association, and was a partial report from the Bureau of Standards on burning. The boy read that over and he immediately saw that someone had been thinking; someone besides a theoretical man, someone who had gone to the bottom of it. He read it over again and then he took it out to his head burner. He said, "I wish you would read that over, at your leisure, and when you get through, read it over again, and let me know what you think about it."

The burner came back a little later and said, "It won't do. There is nothing to it It is too dangerous to fool with." He said, "I have burned brick in just about that same length of time, but five days, or five and a half days—you can't do it, and make a regular practice of it." When asked why, he said, "A man couldn't stand it, he'd have to be right on the job every minute of the time. I wouldn't have anything to do with it."

"All right," said my boy, "I am going to take that and burn a kiln myself according to that paper."

He took charge of it and burned the kiln off in about five days and four hours. We had been burning an average of eight and a half to nine days, and since that time we have adopted the plan entirely. We followed out the suggestions to the letter, and we

have cut our burning time down to anywhere between five and five and a half days. Before we tried that we didn't have kiln room enough, and now we have kilns standing idle. We have reduced the amount of fuel and labor also, and I would say that we are saving enough on this one investigation of the Bureau of Mines through the coöperation of the Common Brick Manufacturers Association for me to contribute a fellowship to the Bureau of Mines individually, but I feel like Andrew Gump. He lost all his money in the hairbrush and mirror business and as soon as it came back to him he told them immediately, "I knew I could arrange some way to get it back."

I am not wanting to give what I have already gained by this information, I am wanting more information. I am willing to start over again and contribute with the association.

CERAMIC STUDENTS WIN FIRST PRIZE IN THE UNIVERSITY OF WASHINGTON ENGINEERS' OPEN HOUSE

The ceramic engineering students, College of Mines, University of Washington (Seattle) competed with the departments of Civil Engineering, Mechanical, Chemical, Forestry, Fishery and Electrical Engineering and walked off with the first prize. Exhibitions were made of the manufacture of brick and tile; pottery by the hand throwing, casting and jiggering methods; glass tumblers; spraying and firing of terra cotta; purification and filter pressing of Eastern Washington kaolins; manufacture and testing of super-refractories and enameled metals. Over 200 two-inch brown and white jugs made by the students together with 50 colored vases were given out as souvenirs. The Engineers' Open House is given every two years at the University of Washington and has quite a reputation for high class exhibitions. Several thousand people visited the department on Friday and Saturday, April 11th and 12th.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21–Aug. 1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn. Inc.	Oct., 1924	
Am. Iron and Steel Institute	May 23, 1924	New York
British Assn. for the Advancement of Science	Aug. 6–13, 1924	Toronto, Canada
Chamber of Commerce of the U. S. A.	May 6–8, 1924	Cleveland, Ohio
Chemical Equipment Assn.	Sept., 1924	
Colloid Symposium	June 19–21, 1924	Northwestern University, Evanston, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec. 9, 1924	New York (?)
Manufacturing Chemist's Assn.	June, 1924	New York
Natl. Assn. of Mfrs. of U. S. A.	May 19–21, 1924	New York
Natl. Assn. of Stove Mfrs.	May 14–15, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	Last Wk. Apr., 1924	Atlantic City

Organization	Date	Place
Natl. Glass Distributor's Assn.	Dec., 1924	Pittsburgh
Natl. Lime Assn.	May 20–23, 1924	White Sulphur Springs, W. Va.
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Mfrs. Assn.	Dec., 1924	
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	May or June, 1924	
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh
Western Society of Engineers	June 4, 1924	Chicago

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Vol. 3 | June, 1924 | No. 6

EDITORIAL

SCIENTIFIC RESEARCH AS AN ASSOCIATION ACTIVITY[1]

By H. E. Howe[2]

How slow industry has been to avail itself of the benefits of science and to give it a real opportunity to demonstrate its potentialities!

Many men have been signally successful because of their alliance with science. Others have stood by marveling but blind to the example set before them.

Pasteur, whose remarkable discoveries saved France a sum estimated as far greater than the indemnity paid to Germany at the close of the Franco-Prussian war, said, "In our century science is the soul of the prosperity of nations and the living source of all progress. Undoubtedly the tiring daily discussions of politics seem to be our guide—empty appearances. What really leads us forward are a few scientific discoveries and their applications."

Ten or twelve years ago Robert Kennedy Duncan pointed out that "during the next five years the small manufacturer who is swept out of existence will often wonder why. He will ascribe it to the economy of large scale operations or business intrigues or what not, never knowing that his disaster was due to the application of pure science that the trust

[1] Presented at the Atlantic City Meeting, Feb., 1924 (General Session).
[2] Editor, *Industrial and Engineering Chemistry*, Washington, D. C.

organizations and large manufacturers are already beginning to appreciate."

It is true that many of our great discoveries have appeared to be by chance, but it can be demonstrated that these were made by trained observers systematically searching for new facts. Inventions are rarely made to order. To quote Dr. W. H. Bragg, a noted British scientist:

"It is easy and fascinating to suppose that a new invention is found as complete and clean as a nugget of gold, as unexpected and as unconnected with its surroundings, and finally as readily convertible into cash.

"The truth is very different. Science does not increase by the constant addition of new facts to old as a literary collection increases by the addition of new books or a museum by the addition of new specimens and curios. Science grows like a tree, which shoots out new branches continually and at the same time strengthens the old, always growing higher into the light. Like the tree, science needs wise cultivation. The nourishment of the tree, its training and pruning have their true counterparts in science. In both the fruits come as the reward of skill and labor."

To gain the greatest benefit from applied science, individual manufacturers should establish their own research and control laboratories. These laboratories should be well equipped and manned, made attractive places to work, be adequately supported and genuinely considered an intimate, integral, internal part of the organization. A laboratory can become more important than the sales or the advertising department. The Hadfield Steel Works in England have actually become attached to the research and control laboratory rather than the laboratory attached to the works.

Every industry finds it necessary to engage upon fundamental work, work in the field of pure science, upon which the so-called practical work or technology depends. Occasionally, indeed often, industrial laboratories undertake this work on their own account, but the work involved is so extensive that the individual corporation is seldom justified in doing it as thoroughly as is required.

The results of fundamental science research should not be left unpublished, since their disclosure can repay only in part the debt which any organization owes to science. Fundamental data do not of themselves alter the relative positions of competitors. It is the ability to apply the information that makes the difference between the success of these rivals.

An appreciation of these facts has led to associations engaging upon programs of scientific research. The great advantage gained early in the war by Germany, due largely to thorough organization among her scientific men and the confidence which her manufacturers have always had in science, impressed itself upon Great Britain. She saw the necessity of meeting such organization with an organization of her own scientists and set up an Advisory Council of Scientific and Industrial Research. This

council later became a department of the government, and known as the Department of Scientific and Industrial Research. This has been followed with some slight changes by the various English possessions. In Great Britain a million pounds was set aside by the government to encourage associations to put money into the work of organization, laboratory equipment, and staff. Pound for pound has been the plan for such organization and more than twenty-five associations have been formed, licensed, or are in process of formation. A further grant of a million pounds has been recommended by the government for another five-year period.

In America it has seemed best for associations to conduct their scientific activities without the aid of government money, for with the use of public funds there always goes a certain amount of necessary control which becomes irksome. Our trade associations have been formed without regard to scientific work and have undertaken this work only after a long period of education, during which it has been demonstrated that even competitors can work harmoniously on a scientific program.

A large number of the American associations began their work with standardization. The United States Bureau of Standards has prepared a report on the standardization of work going forward in 102 trade associations. Such work has been of real value.

We shall here recite the experience and methods of a few of the American associations.

California Fruit Growers' Exchange

The California Fruit Growers' Exchange, a coöperative, non-profit, non-capital stock corporation composed of 12,500 growers, organized a research laboratory primarily to develop methods for the conversion of the lower grades of citrus fruits into stable, salable products. The laboratory is operated at an approximate cost of $12,500 per year. Funds are obtained by an assessment of so many cents per box of fruit marketed. As a result of the work accomplished in coöperation with government agencies, the research laboratory has won an established place in the citrus industry.

The Magnesia Association of America

In contrast with the California Fruit Growers' Exchange, the Magnesia Association of America consists of only four manufacturers of magnesia products. Its purpose is the determination of constants and engineering data relative to the use of 85% magnesia as an insulating material, and the education of engineers, architects and plant owners to the importance of using insulating material in accordance with scientific data. The income of the Association is secured by a flat percentage tax laid on the actual goods shipped. The Association is operated on a budget system. Its

income has varied, depending upon the extent of activities, from a minimum of $20,000 annually to $125,000. This Association finds it advantageous to conduct its scientific work through a fellowship established at the Mellon Institute of Industrial Research. The findings of this research are given wide publicity, generally through the engineering and technical papers but to some extent through popular magazines and directly by mail.

National Canners' Association

Among the most successful has been the National Canners' Association. The fees for membership are one per cent per case of canned goods manufactured, and in addition to the support of the secretary's office and general machinery of the Association, including commodity advertising, the income is devoted to certain lines of informational work and scientific research. As conclusions are reached, valuable publications are issued. The laboratory carries on coöperative work in several important directions.

In some cases arrangements are made for the work itself to be done in laboratories outside the Association, but in coöperation with it. In matters of education, trade promotion, improved forms of reports, standards and research, the laboratories of the Association and the Association itself coöperate fully with both state and federal governments. Appropriations for single items of research have become as large as were the original allotments for the entire research program (about $30,000).

Clay Products Association

The Clay Products Association has undertaken research upon the study of the manufacture of salt glazed vitrified clay pipe. Results have not yet been reached, but it is gratifying to find that those interested in one of the world's oldest industries—ceramics—have found that it will be well to supplement many, many years of experience with scientific data.

In addition to research at Mellon Institute the Clay Prdoucts Association maintains a physical and chemical laboratory in Chicago where many problems directly affecting the use of their materials are studied. The Association is also engaged in the preparation of a handbook for the use of engineers, architects, and others, and feels that its scientific program is well worth while. The income of the Association is based on the amount of goods sold and the budget includes items for the scientific work decided upon for the year in question.

American Malleable Castings Association

The American Malleable Castings Association realized that the considerable number of inferior castings being made by the trade interfered decidedly with development of the market for malleable castings. The

Association formed a research committee, equipped a laboratory, secured a competent director, and began the work of so improving the products of every member of the Association that malleable castings would sustain a reputation for high, dependable, and uniform quality. The work has been going on for the last ten years, which is a testimonial to the high regard which the members of the Association have for research.

I believe the members who formerly made the best castings continue to do so, but the industry as a whole is far better off and the work of the Association in this direction has attracted attention in most of the countries abroad.

The Association spends about $150,000 per year in research. Work on control, in addition to research, is conducted at the expense of individual members for their benefit.

The various plants are visited each month to inspect castings and when quality is found to be deteriorating specialists go at once to see the trouble and endeavor to solve the problem.

Inspectors also see to it that the castings shipped by the producer are equivalent in quality to the test bars submitted to the laboratory.

A research committee meets the second Tuesday of every month in Chicago, followed by a regular meeting of the western members of the Association. The third Friday of each month finds the eastern members meeting in New York City. Joint meetings of eastern and western members are held quarterly in Cleveland.

American Gas Association

In the American Gas Association most of the income is derived from membership dues, of which there are two classes—company members and individuals. In addition, a charge is made for certain special service rendered to members and there is some revenue from the sale of publications.

The Association is rendering a very definite service to its member companies. It has upon its staff two members available for either field or installation work. Operating problems, industrial fuel development heating standards, the examination of gas appliances and gas consuming devices as regards fire hazards, efficiency, etc., indicate some of the lines of endeavor.

The Asphalt Association

The Asphalt Association is one of the newer industrial groups, having been formed in May, 1919. The members are assessed $100 annually as dues, but no additional payment is made by them. Contributing members pay a lump sum yearly, fixed by the Board of Directors in general conformity with the extent of business done by them and benefits to be derived.

This is generally an assessment varying from 32 to 40 cents per ton of paving asphalt sold. The Association was formed to increase the market for asphalt in paving, and in order to carry on its educational program and do constructive work, it calls upon science. This has to do not only with asphalt itself, but with the chemical and physical factors involved in its application, coöperation in designs for highway construction and the behavior of asphaltic types of pavement under various conditions of service.

Paint Manufacturers Association

The Paint Manufacturers Association of the United States and the National Varnish Manufacturers Association support an educational bureau. The educational bureau is supported by five-year subscriptions which range from $50 to $10,000 annually. These are voluntary upon the part of members of both associations and any others interested in the work. The funds for the bureau are kept distinct from the treasuries of the two associations.

The educational bureau has carried on research and experimental work for a number of years and published the results widely. It has studied special applications of paint and varnish and has developed new compounds, as for example, a special paint designed to reduce the fire hazard of wood shingles. When a new formula is devised and developed to the manufacturing stage, it is the custom of the associations to grant licenses for its manufacture to members of the associations.

Silk Association of America

The Silk Association of America has directed much of its attention to the conditioning and testing of raw silk. It has made important contributions to the subject and has performed a service in coöperating with foreign producers. This has led to silk being brought to our market in the condition best suited to our uses. Tests acceptable to both buyer and seller have been devised and there are many phases of silk production which have engaged the attention of the Association. These include testing of dyes, researches upon the fastness of colors to sunlight, fundamental work upon the physical constants of the individual silk fibers, etc. The conditioning house makes a charge for the work done and is owned by the Association. The work done is more satisfactory than was previously possible in a similar establishment privately owned.

National Association of Cotton Manufacturers

The National Association of Cotton Manufacturers has given extensive consideration to research in the cotton industry. Beginning with a research committee, upon which were cotton mill men and scientists, a larger

program has now been worked out. A research secretary has been employed who in addition to a certain amount of service work will travel in order to learn at first hand those problems confronting the various members of the Association which may be solved through applied science.

American Institute of Baking

The American Institute of Baking is one of the major activities of the American Bakers Association. The Institute is the outgrowth of an idea backed by one or two individuals who learned from personal experience what applied science can do for them. From a modest beginning the Institute has now advanced to the place where it owns a building, is giving short instructional courses, performs a plant problem service, and conducts research on problems fundamental to baking. A bulletin on the technology of the business is issued. Support has come to the project in such volume that a broad program has been made possible and is being put into effect.

This experience of the bakers is made even more interesting by the fact that by far the majority of commercial bakers would consider themselves unable individually to afford a laboratory or take on any expense which might not lead to immediate returns. Through the coöperative effort in which they are now engaged, the trade as a whole is able to avail itself of new principles and methods which otherwise would have been impossible.

American Society of Heating and Ventilating Engineers

The American Society of Heating and Ventilating Engineers devotes about $25,000 a year to its research laboratory. The funds are raised by popular subscription and the work is done in coöperation with the U. S. Bureau of Mines, Pittsburgh laboratory. More than twenty definite research projects have so far been undertaken. No tests, experiments or research are conducted for compensation.

Association of Manufacturers of Chilled Car Wheels

The Association of Manufacturers of Chilled Car Wheels has for its purpose the advancement of knowledge concerning the manufacture and service of car and locomotive wheels by discussion, investigations, and reports of experience of experts and of members of the Association. Information is gathered and distributed on the manufacture and service of car and locomotive wheels. When the organization was formed, every car had a special design of wheel. The Association has succeeded in standardizing to four types designed for cars of different capacities. These four take the place of about 175 patterns.

A consulting engineer is retained on full time and a physical laboratory

has recently been installed to further the work of the Association. There are 25 members of the Association.

Funds are obtained by assessment, based upon the capacities of the plants. Assessments in amounts of $5,000 are levied when funds are required. The total expense of operating the Association in a typical year was estimated at $40,000.

Portland Cement Association

The Portland Cement Association represents more than 90 per cent of the total production of Portland cement in the United States. In 1905, they began to discuss a research laboratory for the Association but a definite plan of action was not decided upon then and funds were not available. From 1916 on, the present activities of the Association were developed, having to do principally with scientific educational and promotional work. District offices are maintained to give service to users of cement, and through the structural materials laboratory research has been carried on and has proved its value to manufacturer and user alike.

A corps of engineers, chemists and assistants give their entire time to the work and the results are published in the form of papers presented by them before scientific societies and in bulletins issued by the laboratory for general distribution. The annual budget runs into several hundred thousand dollars, which includes the cost of maintaining the service engineers in the various district offices.

The research has to do largely with devising means for using local materials, and fundamental study on the part played by various components to concrete and cement, and the influence upon strength of such factors as temperature and moisture during setting, excess water in mixing, and similar factors. Assistance has been rendered in designing standard structures and in devising uniform rational construction practice.

National Lime Association

In its effort to give the public better information on lime to the end that it may be used more accurately and to follow up its educational work properly, the National Lime Association has found that in even so old a material as lime there is much need for investigation and research. This touches upon the properties of the materials produced in the different quarries and with different equipment. Much time is spent on the peculiar application of lime in more than 165 industries.

The investigational work of the Association is conducted not so much in its own laboratories as in coöperation and collaboration with other institutions which have a common interest in lime. A considerable amount of work is done through industrial fellowships in different institutions, this

work being directed jointly by the director of the Association and a representative of the institution concerned.

The data obtained are published and distributed among those interested, whether it be on lime for construction purposes, for agriculture, or for the chemical field.

Funds are secured by assessment on the product of each member in the organization, levied at so many cents per ton of lime produced, the amounts being fixed each year by members in convention assembled.

The Tanners' Council

The Tanners' Council of the United States of America includes nearly all the producers of various grades of leather. Previous to the war, a research laboratory was established which has since been reorganized upon a broader plane and encouraged to proceed with fundamental work as contrasted with service work on raw materials of one kind or another. The Council was instrumental in furthering a school where those in the industry might gain knowledge to make them better craftsmen. The council now has under consideration a comprehensive plan for the establishment of not only a school for craftsmen but for advanced students and for research through direct appropriations from council funds. An appropriation of $110,000 has been made recently for a new research laboratory.

The Refractories Manufacturers Association

The Refractories Manufacturers Association has been engaged in research for over five years, the original yearly appropriation having increased about 500 per cent. At first, only problems of general interest were studied and this policy was followed for about one year. At that time it became evident that many of the research problems of the various companies required special study. These studies can be made by following certain definite procedures, but the results are affected by operating conditions at the various plants.

The refractories industry, especially that branch which is devoted to the manufacture of fire-clay brick, does not work with a standard material. The physical properties of the clays vary as does the process of manufacture. It is this situation that limits the application of many of the results that may be obtained by research. Consequently, it was decided to make the research facilities of the Association available to the members by the payment of a fee necessary to cover the expense of an individual investigation. This latter field has been most profitable and popular, for the results are immediate and have a definite application. The experience gained by studying the same problem at different plants has been invaluable and often has made possible the expression of an opinion or

recommendation without additional study as the problem continues to arise.

There is an extremely large field in this industry for the study of conditions under which the product is used. As these studies progress certain facts become evident. In some cases, the product is used with shameful ignorance as to how it should be treated, yet when ultimate failure results it reflects upon the producer. Careful study has developed information on many of the evil practices that are common. On the other hand, certain raw materials cannot be used for many purposes; the shrinkage may be too high, the refractoriness too low, or the strength insufficient. In other cases, complete knowledge of service requirements enables the production of suitable ware.

An unforseen development of this plan has been in connection with matters of a more business-like nature. An accumulation of extensive data is of great benefit in many of the every day problems that come up, regarding specifications, tariff matters, trade development, and similar examples. The centralization of data regarding similar products permits the formulation of policies that would otherwise remain undeveloped under conditions where each manufacturer is forced to protect his own interests without knowing how others may be affected.

American Meat Packers Institute

The achievements of scientific research in the packing industry have become a classic and are often used to illustrate how exceedingly profitable research can be made in commerce. Every packing house of any consequence maintains a research and control laboratory. In view of these facts it is particularly interesting to note that a concerted movement has been initiated by the Institute of American Meat Packers looking toward the establishment of an Educational Institute. It is recognized that there is at present duplication of research work, that there is a limitation of research to such lines as may be expected to return a quick profit, that the individual companies—and there are 257 of them in the Institute—have their development limited by their own experience, that no effort has been made to systematize this industrial experience, and that the future is limited by the progress of the present. The industry is looking toward the establishment of a central distinctive home where technical men may be trained to succeed those now active in the packing industry, where by providing facilities for a broad training the executives of the future may not be specialists in such narrow fields as many departmental executives of the present régime are known to be.

The Institute is to become an organization which will combine the activities of a research institute, an educational center, a trade association,

and an industrial musuem. To quote from the plan submitted by the Institute Plan committee, of which Thomas E. Wilson is Chairman:

1. As a research institution, it should:
   a. Develop and systematize a body of scientific and practical data for the service of the whole industry.
   b. Carry on agreed researches into new scientific and practical problems common to all packers, without infringing on research along individual lines being done by specific companies.
   c. Conduct experiments on the extension of products and reclamation of materials (except where such experiments would infringe on original work done by some individual company.
   d. Collate and disseminate information concerning discoveries and developments having relation to the packing industry, without invading material developed by particular companies.
   e. Conduct merchandising surveys and commercial research work.
   f. Discover waste and means of eliminating it.
   g. Test materials and equipment offered to the industry.
2. As an educational institution it should do at least three things.
   a. Provide broad but specialized collegiate education for young men intending to enter the packing industry, just as the Colorado School of Mines provides such training for young men expecting to begin their work in the mining industry.
   b. Furnish special training to intermediate sub-executives (prospective departmental heads) of promise already engaged in the industry.
   c. Conduct a continuation school for plant employees and junior office help.

3. As a trade association, it should continue to do what the Institute is now doing in this direction.

4. As an industrial museum, it should provide space for permanent exhibits of models showing modern packing-house operations, specimens and processes; and it should rent out space for exhibits of materials of industrial value, and for a permanent exhibit of packing house machinery and supplies—a sort of scientific museum and centralized market place, a gigantic permanent show window, conveniently located (being at Chicago) where packers from all parts of the country may come and view samples before making purchases and installments.

Plans for Coöperative Research

Many other associations are engaged in coöperative research on plans as diversified as are the industries represented. Many associations prefer to use their own laboratories, man them, and direct the work. Other associations begin by supporting a fellowship at one or more of our uni-

versities. Some rely upon the excellent facilites of some of our commercial laboratories or consulting engineers. Others make existing laboratories in plants available for the problems assigned and may begin with a sort of informational clearing house on existing knowledge and the state of the art as disclosed by the literature. Societies themselves may be formed, like the American Bureau of Welding, and the Crop Protection Institute, where all interested may meet on common ground and apportion the work, oversee it, and through the means of committees obtain funds from members and conduct experiments without actually establishing a separate laboratory.

Another plan is that of coöperation with various government laboratories. Research associates are placed in these laboratories under the direction of the head of the bureau but with the program arranged with the assistance of an advisory committee representing the industry. At the Bureau of Standards in addition to research associates placed by single companies, scientists are maintained by the National Glass Containers Association, the Hollow Building Tile Association, Associated Tile Manufacturers, and the National Gypsum Association.

At the Bureau of Mines we find as coöperators a number of Chambers of Commerce, individual companies, universities, and public service corporations. The Southern Appalachian Coal Operators Association and the American Society of Heating and Ventilating Engineers also work with the Bureau of Mines. The Heavy Clay Products Associations and The Refractories Manufacturers have coöperated with the Bureau of Mines in an extensive survey of possible economies in kiln firing. In general the Bureau contributes the time of specialists, the equipment in housing, and other substantial assistance.

The results in all cases where government coöperation is involved are made public at the conclusion of the work.

The Forest Products Laboratory, the Department of Agriculture, and its various bureaus, and other government agencies are frequently available to organizations conducting research where the public good is involved.

Conclusion

It has been shown that research can be successfully conducted by the association plan, whether the association be composed of a small or a large number of individuals, that there is a precedent for nearly any type of association; and that there are many methods for securing research funds. In general these are based either upon the gross business done, the capitol stock, the number of employees, items of equipment, or the number of packages of products shipped. Voluntary contributions form another somewhat less uniform basis.

There are facilities and plans for carrying on a research program to suit any association activity, and a start can be had with a director of research who can survey the field, tabulate the problems and set up an informational clearing house, if funds are not available for a more extensive program. As money becomes available, fellowships can be established, special problems assigned to individual laboratories, and in time if desirable, a laboratory can be set up and maintained by the association for study exclusively upon its problems.

There is still another possibility. I refer to a technical society, such as the AMERICAN CERAMIC SOCIETY, coöperating directly with trade associations in planning, supervising, and even executing a carefully selected scientific program. The SOCIETY could in fact be the Ceramic Research Institute in which the several Ceramic Trade Associations could have a common interest and control, and the most economic directing of their technical and scientific problems. This would be employing a going organization, well organized, productive and rapidly growing in strength which the Ceramic Industries are even now supporting and governing. This would merely be employing that which the ceramic industries already have. The only thing necessary to make the AMERICAN CERAMIC SOCIETY directly and immediately available to the several ceramic trade associations is a change in the scheme of the SOCIETY organization and control of finances whereby the trade associations would be the controlling agents for their firm members, jointly with the several other ceramic interests which perhaps could not readily be represented through trade associations. This sharing in control of the affairs of the SOCIETY by trade associations could be arranged by constitutional provisions so that the individual members would gain rather than lose in their rights and benefits of membership. It would affect that happy union in service of the financial and the technical industrial executives.

WASHINGTON, D. C.

PAPERS AND DISCUSSIONS

LONGER LIFE OF OUR TANKS[1]

By C. A. Modes

What is meant by the life of a glass furnace?

It is the period of time during which a furnace will furnish a fixed tonnage of glass of quality that will permit a maximum production of articles which measure up to the standards required by the consumer. The producer's interest lay in the attainment of certain quality, clarity, luster and strength. Quantity production requires a working quality of the glass that will not slow down operations, and after the ware is made, will not be lost due to strains.

We shall consider only glass tanks operating under modern conditions, supplying glass to automatic machines. This operation is intensive, twenty-four hours of the day, and six to seven days of the week.

From the time the glass is given to the machines there must be no interruption of flow from the furnace. This condition demands that the temperatures must be kept constant while the raw materials are being brought into solution and that while the furnace is "under load" certain "working temperatures" must be maintained. The results to the glass in the bottle are serious with the most perfect batch if the proper temperatures are not maintained.

Money is invested in the construction of a furnace to produce the maximum number of pieces per twenty-four hours. Each piece has a fixed sale value which must cover such charges as tax, cost of construction, raw material, fuel, maintenance, labor, selling costs, etc. Given a furnace which will consistently furnish a given quantity of good glass per twenty-four hours there is a potential profit if it can be made to produce 110% or 115%. It is a tempting opportunity that soon brings about an overload. The larger quantity of raw material requires a larger heat input to maintain the required tank temperatures. Indeed the working temperatures must be higher if there is to be a shortening of the time interval between the introduction of raw materials and the drawing of refined glass. In this we may for a time succeed, then the results of overstraining and overheating of the tanks begin to show. The furnace has not withstood this more severe treatment. Another repair bill has to be paid. Production is halted which in turn may mean loss of customers. Will the year's profit and loss statement reflect the anticipated earnings from this over-burdening of the tank?

The question of how long a modern machine furnace should last is one that cannot be determined without careful consideration of all these relating factors. Some basic units of production will have to be adopted,

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Glass Division).

for example an average producing capacity of twenty-five tons of good glass every working day for a period of twelve months. In this standard schedule, allowance would have to be made for the time required to repair the furnace, and for the gradually decreasing furnace efficiency due to erosions of the materials, which would require heavier loads and more heat input when the furnace was first started. At the end of the twelve-month period just as good a glass and as good ware would have to be made from this furnace as at any time.

Careful record would have to be made of the construction, hourly temperatures, fuel used, glass produced, batch melted, temporary repairs, minor maintenance, etc. The time taken to heat from 70° to melting temperature and the methods used would have to be known. These conditions and practices vary quite widely in different glass plants, each operator believing his to be the only safe procedure. And they are justified in their opinions by the results they obtained but nevertheless without a standard basis of rating it is impossible to make comparisons on "life of tank."

Unfortunately, however, there are many influencing conditions and factors which cannot be forseen in the carrying out of the most exact procedure. Even when the furnace is rebuilt with satisfactory block the chances are it will not operate with the expected efficiency. We are confused and have nothing to offer but opinions in lieu of explanation and this is not the way to solve the question. The block-maker is blamed as is the builder and the operators. We try again. Somewhere in the construction and operation we varied widely from the specifications.

Two factories both using blocks of the same make, one is convinced that a 12-inch and 15-inch thick block is the best while the other believes a 10-inch and 12-inch block is the best. The first plant condemns the quality of the blocks on the basis of short life on the furnaces, while the second plant has success with the thinner blocks and produces more glass per square foot of melting surface than does the first plant, temperatures used by both being the same.

In a certain plant two furnaces are operated, one furnace by a thermal engineer using all the refinements and means of control possible. The other furnace of similar construction operated without these refined control devices, produces as much good glass per pound of fuel as does the first. In this case the furnace design and construction are the most effective factors and if given the same ratio of heat input and same charge of glass batch per day, their productiveness will be equal.

One attractive problem is the small amount of heat used in the actual melting of a pound of glass, the high heat loss at the exterior of the furnace, and suggestions of how to conserve more of the heat for glass making. The answer is proper insulation. There are certain portions of our fur-

naces that can be insulated without shortening the life of the furnace, and there are other portions which, if insulated, would rapidly deteriorate.

Recently I saw an attempt at insulation of the high temperature portion of the furnace. I would not recommend any one to repeat this experiment.

Makers of refractories frequently offer a new idea in shape, size or make of block as a cure for tank failures. Unfortunately the glassmaker must put the material to actual test before either the blockmaker or he knows the positive results. If it is a success the blockmaker is elated and tells the other glass makers; if a failure, he is silent and the glassmaker is sorry.

There is too much empiric in the production of tank blocks. Blockmakers, however, are sincere in their efforts to furnish the longest life blocks.

By "blocks" I mean blocks used below the glass line. The refractory material used in construction above this flux line if properly constructed, is not a factor in the life of the furnace. It is below the flux line where our troubles are had. The blocks above the glass line may be and in most cases should be of quite different materials than those used in the blocks with which the glass is in contact. This requires different clays and different mesh grog, which results in different density and coefficient of expansion. The blocks used in contact with the molten glass are made to withstand high temperatures and the erosive action of the batch materials. Careful attention must be given this portion of the furnace throughout the life of the furnace.

The reported "long life" of some furnaces is creditable to the furnace having been operated much under capacity and the "short life" of other furnaces is chargeable to poor construction or poor handling during the heating-up period.

Each plant has its problems and I cannot see the possibility of anyone making specific recommendations for longer life of furnaces until agreement is had on what the expected time a furnace should operate, and what shall be a normal quantity and quality production of glass. Decision can be made only by a group of reliable men conscientiously considering materials and construction. They would have to assemble a large amount of actual operating data. This would require time and the confidence of furnace operators.

ILLINOIS GLASS CO.
ALTON, ILLINOIS

DISCUSSION ON "EXACT NOTIONS OF FLUORINE ENAMELS"[1]

(Reply to J. E. HANSEN'S Discussion)

CHARLES MUSIOL: Mr. Hansen believes that no loss of SiO_2 is visible in his examples, notwithstanding the fact that the fluorine is entirely driven out as SiF_4 on which the calculations were made.

[1] C. Musiol, *Jour. Amer. Ceram. Soc.*, **7** [2], 105(1924).

Let us take again the analysis "A" and "C" and also "A" "Cx" given by Mr. Hansen and let us examine them after their transformation into "substractive" analysis, according to our method.

Let us first suppose that the analysis "A" should not have undergone any change; it should have remained "A." In consequence we should have:

$$\frac{\text{values of "A"}}{\text{values of "A"}} = 1$$

it is to say that these quotients would have remained equal to the unit.

TABLE I

	"A"	"C"	"Cx"	values "A" / values "A"	values "C" / values "A"	values "Cx" / values "A"
Na_2O	17.40	18.34	18.10	1	1.054	1.040
K_2O	1.69	1.78	1.79	1	1.054	1.059
CaO	5.59	5.89	5.93	1	1.054	1.060
MnO	1.03	1.08	1.09	1	1.050	1.058
CoO	1.14	1.20	1.21	1	1.053	1.061
B_2O_3	13.85	14.60	14.32	1	1.054	1.035
Al_2O_3	5.70	6.01	6.05	1	1.054	1.061
SiO_2	50.90	50.50	50.90	1	0.992	1.000
F_2	3.68	...	...	1	...	...
	101.55	100.00	100.00	...	...	...
$-O$	1.55	...	...	1	...	...
	100.00	100.00	100.00			

Let us look now at the quotients of the analysis "C" and "A" and of the analysis "Cx" and "A." We immediately see by the difference of the quotients that in the first case there is complete disappearance of fluorine and loss of SiO_2, and in the second case complete disappearance of fluorine, loss of SiO_2 and a feeble loss of Na_2O and of B_2O_3.

This proves without any doubt that the mere "chemical data" are not sufficient to conclude and that they may, without the mathematical proof, make the chemist the victim of his fallacy.

I think Mr. Hansen is wrong when he excludes the mathematical means from chemistry, for both methods must complete each other.

Any enamelist knows that any mixture of chemical products, applied to the enamel-batch, put into the melting-furnace consists of two parts:

1. The former, which gives the enamel generally represented by a molecular formula, and

2. The latter, which containing products such as water, organic bodies, different gases, etc., evaporates or disappears, forming perhaps new chemical combinations, and is not represented in the formula of the enamel.

My article only treats those phenomena which refer to the first part of

the enamel-batch, *i. e.*, to the enamel and it has not at all touched the question of the second part. Therefore, the statement that the "fluorine escapes as such," *i. e.*, from our enamel-formula, is correct.

What may occur with this fluorine in status nascendi when it gets into contact with the second part of the enamel-batch, is quite another question, not discussed by my article.

For this reason I am obliged to reject the sentence of the abstract expressing that "the fluorine disappears during the melting process as F_2," because I did not pen that myself.

To the question of Mr. Hansen as to where I obtain the oxygen to form the CaO of CaF_2, I wish to make reference to the reaction which takes place in submitting the fluorspar to red heat in a steam-atmosphere, according to the formula: $CaF_2 + H_2O = CaO + 2HF$.

The presence of water in any enamel-batch is to be found under the form of humidity, hydrated water, water of crystallization coming namely from the boracic compounds when the enamel is not boronless.

Let us take as examples the typical American enamels published not long ago by Mr. Wolfram:

100 kg. of ground-coat-batch at 32% borax contains 15 kg. cryst. water
100 kg. of white enamel batch at 25.5% borax contains 12 kg. cryst. water

These quantities of water are more than sufficient to satisfy the demand of oxygen which should be necessary for the substitution of the fluorine.

Whether the fluorine disappears under the form of SiF_4 or under any other form constitutes an academic question which may be of some curiosity to the chemist, but which is not useful at all for the enamelist. The vital question for the latter is to know whether or not the partial disappearance of the fluorine always involves a decrease of SiO_2, as certain chemists pretend.

H. H. STEPHENSON: Mr. Hansen has pointed out, I think very justly, the improbability of the element fluorine escaping. The following list includes most of the possibilities, some of them very remote and in fact hypothetical.

(*a*) From the enamel: SiF_4, BF_3, HF, NaF, KF, SnF_4, SbF_3, TiF_4, and their double compounds.

(*b*) From the atmosphere: The formation of a compound of F with O or N or both, nitrides, NOF, NH_4F.

(*c*) From fire gases, if present: The formation of a compound of F with a saturated or unsaturated carbon compound (cyanamides, etc.).

Before seriously considering (*b*) and (*c*), it would have to be shown that an enamel behaves differently when heated in a vacuum or in a quite indifferent gas to what it does in air. But in view of the fact that almost all of the elements present in an enamel are known to form nitrides at high temperatures, and that nitrides with H_2O form ammonia, the following

equations do not appear to me impossible as temporary and catalytic phenomena.

(1) $CaF_2 + N_2 + H_2O = CaO + 2NH_4F + N_2O_3$.

(2) NH_4F dissociates, the HF escaping or attacking SiO_2 or B_2O_3; and $2NH_3 + N_2O_3 = 2N_2 + 3H_2O$, as in the preparation of N from NH_4NO_2.

Thus one might look for HF, NH_3 and N_2O_3 in the exit gases.

In the (*a*) list, KF boils at 1458°C and NaF at 1705°C; temperatures far above the enamel burn. Their double compounds with other fluorides may be possible.

The problem however has been settled under actual industrial conditions in favor of SiF_4 (excepting BF_3). How does sodium silicofluoride come onto the market in fairly large quantities and at a reasonable price? Simply because it is a by-product of the artificial fertilizer industry. The phosphate rock contains enough silicates and fluorides as impurity to make the escape of SiF_4 noxious and therefore prohibited by law in most countries. It may be objected that this reaction is an acid reaction in presence of sulphuric acid, while the enamel conditions are alkaline. This is not strictly true. A glaze slip may be alkaline, but at high temperatures SiO_2 makes all kiln reactions acid reactions.

Thus SiF_4 and BF_3, formed directly or catalytically, remain the leading probabilities. A well-equipped spectographer would settle the matter in a few minutes (see "Practical Spectographic Analysis," No. 444, Bureau of Standards, Scientific Papers).

J. E. HANSEN: With regard to Mr. Musiol's reply to my discussion of his paper on "Extract Notions of Fluorine Enamels," may I state that I have no wish to exclude mathematical interpretations from chemistry, but that the point which I wished to emphasize in that discussion, and which I still wish to emphasize is that the chemical analysis of the fritted enamel and any mathematical relationship which may exist between the constituents of the enamel in the raw batch and in the fritted condition *are not sufficient in themselves* to show *in what form* the volatile constituents of the batch escaped from it.

The possibilities for various chemical combinations to be formed in the melting of an enamel batch are so numerous, and are subject to such complexities, that even with a combination of chemical and mathematical relationships, no proof can be considered a real *proof* until it is substantiated with chemical data showing the quantity and composition of the gas evolved during the melting process.

Furthermore, all the enamel constituents, when in a molten or liquid state, have a certain vapor pressure, great or small, depending on their individual characteristics and upon the temperature of the smelting furnace. This vapor pressure results in volatilization losses of each and every material, to a greater or lesser extent, which in turn alters the chemical analy-

sis of the resultant fritted enamel, and likewise alters any mathematical relationships derived therefrom.

I am still unable to reconcile Mr. Musiol's statement that "fluorine escapes *as such*" (the italics are mine) with his denial that "the fluorine escapes during the melting process as F_2." Certainly according to the usage of the English language, "*as such*," in this case, can mean only "*as fluorine* (F_2)," and it cannot mean fluorine in combination with any other element.

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire-clay brick to spalling?
2. What difference is there between the properties of a soft mud machine made and a hand made brick?
3. What is the best method of sampling fine ground fire clay for testing? Discuss straight clay and cement mixtures.
4. Can a customer form any judgment of the quality of a shipment by a test made on one brick? If not, how many samples should be used?
5. Can an iron free clay brick be made for blast furnace service?
6. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?
7. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?
8. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?
9. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?
10. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?
11. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Question

Does the grinding (coarse or fine) have anything to do with the resistance of a clay brick to spalling?

Discussion

There are certain finely ground fire brick that resist spalling very well and there are other coarsely ground fire brick that do not, but when other conditions are the same a coarsely ground brick has a higher resistance to spalling. The finely ground brick that stand up well are invariably made

from very refractory clays or clays that do not vitrify at the furnace temperature. The coarsely ground brick that spall badly usually have poor mechanical strength or else are made either from dense burning clays or clays of low refractoriness. The fine ground brick that stand up well can be improved in many cases by coarser grinding; the coarsely ground brick by increasing the strength in some cases or by reducing the content of dense burning clay in others.

I think it was mentioned that the coarse grain brick had a higher spalling than finer grain brick and when these bricks spall it tends to break up this thin film of coarse and a chunk of brick would fall out. This fine grade brick did not spall at all—it wore down very gradually until it was about one and one-half inches in thickness, red hot on the outside. These bricks were tested in an alkali furnace.—RAYMOND M. HOWE.

In almost every paper written on the manufacture of brick for use in malleable iron furnace bungs, it is stated that the best bricks for this purpose are of coarse grind, open texture and light burn. The grinding exerts a great influence on the resistance of a clay brick to spalling but the grain size should be within certain limits. Brick that are too coarse, spall just as readily as those that are too fine.

The following screen analyses are offered as evidence:

	(1) Per cent	(2) Per cent	(3) Per cent
Retained on No. 10 sieve	27.8	19.4	3.7
Retained on No. 20 sieve	18.7	19.8	22.4
Retained on No. 40 sieve	9.2	10.4	14.0
Retained on No. 60 sieve	4.7	5.2	7.4
Retained on No. 100 sieve	4.0	5.3	7.1
Passed through No. 100 sieve	35.6	39.9	45.4
	100.0	100.0	100.0

Samples No. 1 and No. 2 were made from the same type of clay by the soft mud, repress method and given the same heat treatment. Sample No. 3 was made from the same type clay by the dry press method.

Sample No. 1 gave about four heats in service.

Sample No. 2 gave about twenty-two heats in service.

Sample No. 3 gave thirty-three heats in service.

These results seem to indicate that coarse grinding is not the way to overcome spalling in brick made from Kentucky semi-flint clays.—C. E. BALES, Louisville Fire Brick Works.

In conducting some tests on kaolinitic fire clay we found that there was a difference. Those clays did not vitrify. We found that the difference between two bricks of exactly the same composition, one over an 8 mesh screen,

the other over a quarter mesh screen, without any effort to control the percentage except with the natural differentiation of a screen, would make that difference on exactly the same brick. In the average spalling test we only got 3 heats on the 8 mesh, where we got 15 on the quarter mesh.

The manufacturers of Pennsylvania brick are unanimous in saying that a coarse grain brick is the best resistance in spalling in service and in spalling tests besides.—A. F. GREAVES-WALKER, Stevens, Inc., Stevens Pottery, Ga.

It does not seem as though we should be expected to draw conclusions from one article. Perhaps in this case the coarse ground brick would give a very poor value, the mechanical strength being as big a factor in the failure as what you might term real spalling. It seems as though there is a pretty fine distinction there to determine whether the spalling is due to heating and cooling or whether it is due more to a squeezing, a pressure effect, that you might have. With Pennsylvania clays—there is no question but what a finely ground brick can be bolstered up by a coarse grinding; on the other hand with a clay such as the sandy clays of New York, I do not believe you could change their resistance to spalling a whole lot by changing the size of the grain—that is, in actual service, because those bricks are so low in impurities that vitrification probably does not take place very rapidly and when they finally go, they go with a bang. The New Jersey brick is pretty finely ground and they certainly can stand heating and cooling all right. So you get as many different results as you have methods and clays.—F. A. HARVEY, U. S. Refractories Corp., Mt. Union, Pa.

Question

What is the best method of sampling fine-ground fire clay for testing? Discuss straight clay and cement mixtures.

Discussion

In the case of very fine materials like clays and cements, we usually open, in a carload of cement for instance, about twenty-five bags. We have a long sort of a tube, we ram the tube away down into the bag and take a sample out with that tube. We take the twenty-five samples and mix them and pour it down to whatever we want to use it for, sieve tests, etc. In case of bulk shipments we do not get very much fine stuff, but when we do we bore down into the car. Of course it has to be more or less surface sample. We cannot go very deep. In the case of some of our chrome ores, we dig trenches from one end of the car to the other, and clear to the floor.—C. E. NESBITT, Carnegie Steel Co., Pittsburgh, Pa.

In the case of some refractory clays that we suspected of varying greatly and to prove whether they did or not, for every tenth shovel full we took

out a small shovel full, like a hand sample of material, and threw it aside—just loading out of a box car. That resulted in about four barrels of clay to the carload. We sampled that down and seemed to be able to catch it pretty well that way and it did not entail much loss. Loading in wheelbarrows, loading out of the car, they took just a small shovel full and dropped it into a barrel at the end of the car.

CHAIRMAN: Was that ground clay?

MR. ROSS: Some of it was as large as two inches.

CHAIRMAN: Was the sample representative or did the man who took that sample get more lumps than anything else?

MR. ROSS: I stayed on the job for three cars myself and got two men trained so that they would follow pretty well. They did not take lumps—they took average of the material. It ran some but not very much. —D. W. ROSS, Washington Clay Pot. Co., Washington, Pa.

CHAIRMAN: In the shipment of such materials as ground ganister which have various percentages of clay in them for patching and bottom work, the clay goes to the bottom of the car and when it is unloaded very often the material is separated enough so that the mixture in the top of the car has not sufficient clay for plasticity and that at the bottom has a very low fusion compared to what is required. Every manufacturer has his own method of taking care of that. Sometimes it amounts to a bad complaint and expense but on the average I do not think it is customary to caution the consumer about the handling of that clay.

MR. HARVEY: It seems to me the only method which would be fair, of settling that, would be the one suggested by Mr. Ross, by which you take a small portion out of every tenth shovel full or wheelbarrow load, or however it is you are emptying the car.

MR. WALKER: Mr. Harvey has had a great deal of experience in materials of that kind. Couldn't he say something about it?

MR. HARVEY: I am responsible for that question. I wanted to bring out exactly what has been brought out by Mr. Nesbitt, that in the case of bulk shipments it is usually surface sampling.

In loading a car of finely ground material you have, of course, a mixture running from 8 mesh, or 30 mesh, down to 200 mesh. The coarse stuff will run off the surface of that car and you get a bigger proportion of coarse material. The test on that sample will be entirely misleading as to the average content of the car. We have recently developed a method at our own plant which is simpler than the one Mr. Nesbitt uses in the case of bag shipments. We have made a tube about eight feet long which is split along one side the entire length and has a handle through it. We go over the top of the car, push the tube clear to the bottom of the car, give it a full turn and pull it out and use that as an average sample, a cross-section,

at that particular place in the car. I do not know whether that is the final answer on sampling bulk shipments—it possibly is not, but certainly it is much better than getting a surface sample of a car of fine ground material.

If possible, a small amount of the fire clay should be taken at regular intervals as the car is being loaded at the manufacturer's plant. This should then be averaged and about a 10-pound sample taken for testing purposes.

If sample has to be taken after shipment, about twelve samples should be taken from different parts of the car and at least a foot below the surface. These are mixed, and a small sample for testing taken from the average.—E. N. McGee, The Semet-Solvay Co., Syracuse, N. Y.

Mr. Phelps: We have in our laboratory what we call medium sample. We make borings in the top and vibrate those borings in a bottle by an electric vibrator. We vibrate each boring. We set the bottles along in a row and we can get a medium sample. We used tall bottles small in diameter. We take the center of the borings from the car, place them in the bottle and fill the bottle with water. We set the bottle on the top of the electic vibrator, hold the top of the bottle with the hand. The vibration is the same but a very quick medium. The finer will come to the top, medium fine stay to the center, and sometimes we get as many as six separations. We can take those vibrations with a rule and can get what we think is a good test. It takes about half an hour to settle clear up. We have made vibration tests where we could even separate the iron. In that way you can derive a sample for testing which is a fairly good one.

We use that vibrating sample then for the analysis. We make six vibration tests to a car. There may be some variation. We get the nearest and best mixture from the average.

Mr. Harvey: That method would not be at all suitable for mixtures of silica cement or for finely ground fire clay in which you put a certain percentage of calcine. For example, the calcine does not grain as fine as the soft clay unless it is ground separately and your vibrator method would separate the calcine, put it at the bottom—whichever goes to the bottom—and any sample that you took from the center of the tube would not be representative of the shipment.

Question

Can a customer form any judgment of the quality of a shipment by a test made on one brick? If not, how many samples should be used?

Discussion

Mr. Nesbitt: The final analysis is what you get out of service. We cannot test all the brick we get. We have to start some place. We

usually select ten brick out of ten thousand as a representative sample. We get a car of fifteen thousand brick and we take fifteen brick. We try to get good representative brick, we try not to pick the worst or the best. That is our method at the present time.

CHAIRMAN: Do you find that method gives you satisfactory tests which check the service you expect?

MR. NESBITT: We have gone over failures in furnaces and run various tests on them and we find some tests indicate when the service is going to be good and when it is going to be bad. We have found that we can foretell whether this carload of brick is going to give an average life service or whether it is going to be a true failure. We do not say we can do that all the time, but it indicates.

MR. ROSS: I think we cannot lay too much stress on the great value of what Mr. Nesbitt said here—that it ought to give nearly relative results for anybody to use one brick per thousand. His long experience with that would indicate he seems to hit average practice with that number of samples.

MR. HARVEY: Are we to take from this, then, the assumption that one brick does not give us any result? I think that perhaps is what was intended to be brought out here. Every manufacturer frequently runs into complaints and when he traces them down he finds perhaps only one brick out of a shipment has been tested.

MR. NESBITT: Mr. Harvey, I said ten brick out of ten thousand. Ten brick is our minimum.

MR. HARVEY: But this question says—Is one brick from a shipment satisfactory?

MR. NESBITT: Absolutely no.

One method which we have been using is when we receive a carload of brick which looks as though it might be desirable, we take out about twice as many brick as we expect to test. We test the other half and send back to the manufacturer one-half if our own tests do not look satisfactory so we have the manufacturer checking us as well as our check on the manufacturer.—C. P. SPANGLER, Jones-Laughlin Steel Co., Pittsburgh, Pa.

A customer cannot judge a shipment of fire brick by a test of one brick. It is difficult to determine exactly how many brick should be tested, but the results of investigation made by Committee C-8 of the American Society for Testing Materials would indicate from ten to twelve. This, however, is usually impossible where shipments are numerous. In most cases, three or four bricks, picked at random, for each test will give a fair idea of the quality of the shipment.—E. N. McGEE, The Semet-Solvay Co., Syracuse, N. Y.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

August Staudt, Vice-President

The Board of Trustees of the American Ceramic Society announce the appointment of August Staudt of Perth Amboy, N. J., as successor to Raymond M. Howe as vice-president of the Society. This appointment came as a unanimous decision of the Board. The following sketch is taken from the History of Middlesex County, New Jersey, published 1921.

Captains and leaders of industry in their respective lines almost invariably are self-made men. Their lives blend closely with romance, giving an inspiring example of just what energy, perseverance and ability can accomplish. Success becomes part of their everyday activities, and each year is like a stepping stone to still greater and more pronounced achievements.

August K. Staudt stands prominent among the leading citizens of Perth Amboy, New Jersey, and a brief résumé of his life reflects well-earned regards in his chosen field. Tireless energy and broad public-spirited benevolence have been the keynotes of his success, and his notable progress in local circles indicates still more marked distinction in his activities in the time to come. His career is an inspiration.

August Staudt

He was born in Nuremberg, Bavaria, Germany, on December 6, 1869. He was the second child of Conrad and Rosa Staudt in a family of eight children, four boys and four girls. Receiving his education in Germany, and satisfactorily fulfiling his military duties in the Bavarian army, he left his native land in 1891. The five years following were spent in England, America and France, and in this time Mr. Staudt perfected his training as a correspondent in foreign languages.

Upon his return to Nuremberg in 1896, Mr. Staudt became connected with a large local industry, and a year later in 1897, married Katherine P. Vorgang, of Brooklyn, New York, whom he had met on his visit to America and who, in the year noted, was visiting relatives in Germany. Mr. Staudt was soon made superintendent of the Nuremberg factory, but relinquished this position in 1901 to take up a residence with Mrs. Staudt in America.

After occupying a number of important positions in banks and commercial houses, Mr. Staudt associated himself with the Perth Amboy Tile Works, and became a resident of this city. The plant at that time was practically unknown and quite insignificant while the company itself had just been reorganized. It was not long before unexpected difficulties arose, and in order to safeguard the investment he had made, Mr. Staudt was compelled to assume the full management of the small tile factory. He was undismayed, however, despite the fact that his working knowledge of ceramics was quite meager, and with grim determination he resolved to build up the establishment, if possible in any way, and make it one of the successful enterprises of the community.

He took a hand in affairs immediately, donning his overalls and tackling any job that needed to be done. Nothing was too hard for it was a case of necessity and resolve—the plant must flourish. Mr. Staudt established a definite working policy for the organization. He rebuilt what remained of the little defunct plant on the solid foundation of honor and integrity in business—the best products at the right price, and the same treatment of every customer, whether large or small. These principles live with the business now, just as they did in the early days, and they are one of the secrets of the remarkable success which the industry has attained.

Step by step the business thrived and then came into its own. The success has been spectacular, and due to the guiding hand and persevering energy of Mr. Staudt, the plant was developed and extended from year to year, and today occupies a position as one of the most modern and best equipped ceramic plants in the State of New Jersey. The floor space has grown from 6784 square feet to close to 42,000 square feet, more than six-fold; even now, the capacity is taxed to the utmost to furnish the demands of customers, and still more expansion will be necessary in the future.[1] Mr. Staudt can well take pride in this achievement, for with the plant he has grown to enjoy an enviable position among the leading business men in the state. In his treatment of his employees he has shown that he has at heart their utmost welfare and security; he has assisted them to purchase homes for their families, arranging large yearly bonuses for faithfully performed duties. Moreover, he has taken out a large block of building and loan stock for operatives at the plant without their knowledge, and which, when due, will be given to deserving employees.

Mr. Staudt has been a member of the American Ceramic Society, since 1911; past president of the New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society, and has long occupied a position on the board of directors of the latter organization. He is a thirty-second degree Mason, a member of the East Jersey Club, Raritan Yacht Club, Elks Club and other well-known organizations. His name will also be found in the membership list of many worthy societies, giving them the benefit of his support and influence.

Mr. and Mrs. Staudt have one child, Augusta, who was born in Newark, New Jersey, August 16, 1906. The family are members of the Evangelical Lutheran Church.

Dr. Julius Grünwald

The members of the Enamel Division will regret indeed to learn of the death of Dr. Julius Grünwald on April 11, 1924. Dr. Grünwald has done a great deal for the enameling industry, and especially for the enameling industry in this country and England, since his treatises on enameling were the first to be translated into English. The Enamel Division of the American Ceramic Society two years ago awarded Dr. Grünwald a purse for the work he had done for enameling.

"Dr. Ing. Julius Grünwald, born in Vienna on April 23, 1873, came from humble parents. He spent the first years of his life at Steyr (Upper-Austria) continuing his studies at Linz where he finished them in 1891. In the following 5 years he was immatriculated at the Technical High School at Vienna and Brunn, leaving that school in 1897 and taking a position as assistant to the University of Brunn (general chemistry). He then also had a position in the Enameling Works and Metal Manufacturers "Austria" at Brux and Brunn.

[1] Present floor space 79,124 sq. ft. plus 7 sixteen-foot kilns, Jan. 2, 1924.

From 1901–1905 he was engineer in the greatest European Enameling Works Thale at the Harz (Germany). In 1905 he took a position as director of the great enameling work Japy Freres and Co., Lafeschotte (France), from 1912 he entered on a regular course of correspondence with French, English and American, Swiss and other enameling works. He fluently spoke French, English, German, Czech and Hungarian. Though working for the benefit of the works he was connected with and doing a great amount of private scientific writing he nevertheless devoted his spare time for preparing himself for his final examinations writing a dissertation (New Methods for Pickling and Glowing of Steel and Iron) to take his degree which he did in 1910. He then was appointed technical chemist and sworn expert of the enameling industry to the Austrian Board of Trade. In 1913 he became sworn interpreter for French with the Court of justice in Vienna. At the International exhibition at Nancy he received the Great Golden Medal and received the title of an officer in the French Academy (Paris).

DR. JULIUS GRÜNWALD.

During the war he acted as expert at the "Metallzentrale" (State Organization for Metal Goods). Thereafter he established himself at his own office in the center of the town doing much investigatory work furthering the ends which are also the object of this society carrying on an enormous amount of correspondence with enameling works, societies and friends in all parts of the world. He married in 1919.

But his physical being could not stand the stress of many years strenuous, incessant work, the more so as he never would hear of rest and repose. So at last it gave way, terrible fits at intervals took their grip upon him and on April 11th while walking home an apoplexy struck him down in the street."

Besides publishing articles on enameling in every journal and trade paper in Germany, and in foreign journals including our own, Dr. Grünwald is the author of the following books which have been translated into many languages:

"Theory and Practice of Enameling on Iron and Steel," "The Technology of Iron Enameling and Tinning," "Chemical Technology of the Enamel Raw-Materials." Your President especially feels the loss of Dr. Grünwald, for Dr. Grünwald was a warm personal friend of his, and for many years he has been in close touch with Dr. Grünwald's work.

THAT ANNUAL MEMBERSHIP INVENTORY

We told you in the May *Journal* that May 1st was the time of taking a physical inventory of members and dropping of the "no response" group. This sort of pruning is always good for the plant—but my, how we hate it.

The total number of members shown on the membership curve for 1923 was 2241. This means that our net loss in number of members since December 14 is 118.

It is evident that we shall have to have Miss Norah Binns manage this field event. At this season she would be having a whole flock of home runs, boggie scores and nine-second sprinters. She was a most winsome promoter. Under her inspiration there were wins for all and then some. It is safe to believe that as she scans this page she

will be sorely tempted to forsake her "Box of Books" in little old Alfred and return again to the game.

Here is the count to date:

	Personal	Corporation	Total
Net Roster April 14	2020	300	2320
Dropped	209	12	
Net Roster May 14	1811	288	2099
New Members	25	4	
	1836	292	
Resigned	4	1	
Changed to Corporation Member	1		
Net Roster May 14	1831	291	2122

The gross acquisitions in members last year were 452 persons and 85 corporations. The gross acquisitions for 1924 so far by months are:

	Personal	Corporation	Total
January	31	6	37
February	40	8	48
March	29	0	29
April	35	3	38
May	25	4	29
	160	21	181

This means that if last year's record is to be equalled we will have to interest at least 291 more persons and 64 more corporations. 42 personals and 10 corporations per month will turn the trick and bring satisfaction to Miss Binns. Will you do your best?

NEW MEMBERS RECEIVED FROM APRIL 15 TO MAY 15

PERSONAL

Blackburn, H. A., 1450 Rockway Ave., Lakewood, Cleveland, Ohio, Norton Co. Sales.

Blatt, S. F., Prizer-Painter Stove Works, Reading, Pa.

Bonesteele, Sarah H., Victor, N. Y.

Boyne, P. K., 33 Beresford Ave., Highland Park, Detroit, Mich., Ford Motor Co.

Collings, William Arthur, P. O. Box 286, Santa Monica, Calif., Manager, W. A. Collings Co.

Crumley, F. S., 407 Johnson Street, Hammond, Ind., President, Indiana Sanitary Pottery Co.

Ekstrand, E. W., 786 E. Washington, Los Angeles, Calif., Engineer, Whiting-Mead Pottery Co.

Gill, Francis D., ℅ Gill Glass Co., Philadelphia, Pa., President.

Johnson, A. G., 116 Hyland Ave., Ames, Iowa (Student).

Kauffmann, Otto Adolf, Niedersedlitz, Sa., Germany, Partner of Chemische Fabrik, etc.

Kelly, Walter H., Bethlehem Steel Co., Bethlehem, Pa., Refractory Engineer.

Kern, Edward F., ℅ School of Mines, Columbia University, New York City.

Kuechler, Adolph H., 50 Richards Road, Columbus, Ohio (Student).
Maguire, Joseph, 440 Martel St., Bethlehem, Pa. (Student).
Murray, Ernest L., 43 Lewis Street, Perth Amboy, N. J., Plant No. 2, Atlantic Terra Cotta Co.
Nichols, Mrs. George, Syosset, Long Island, N. Y., Syosset Pottery.
Ouffner, Abiram A., 107 Milford St., Mount Union, Pa., Harbison-Walker Ref. Co.
Pegram, James, Carrollton, Ill., Pegram Clay Co.
Peterson, T. J., President Tamms Silica Co., 30 N. La Salle St., Chicago, Ill.
Schmid, Fred, 395 Riley Street, Buffalo, N. Y., Clay Salesman, Butler Clay Co.
Stilson, Alden E., U. S. Bureau of Mines, Ceramic Experiment Station, Columbus, O.
Suydam, Albert G., 405 Hobart Bldg., San Francisco, Cal., Pacific Coast representative, Harbison-Walker Refractories Co.
Tombaugh, R. S., Waukegan, Ill., Chief Engineer, Franklyn R. Muller, Inc.
Weaver, Harry F., Evansville, Ind., Secy., and Gen. Mgr., National-Helfrich Potteries Co.
Zandstra, J. J., % Harshaw, Fuller & Goodwin Co., 107 N. Market Street, Chicago Ill., Salesman.

CORPORATION

Cambridge Sanitary Mfg. Co., D. Keith McAfee, Vice-President, Cambridge, Ohio.
The Ceramist, L. R. W. Allison, Editor, 170 Roseville Ave., Trenton, N. J.
Lancaster Iron Works, Inc., Jas. P. Martin, Mgr., Lancaster, Pa.
Pacific Stoneware Co., Thomas S. Mann, 695 Sherlock Ave., N., Portland, Ore.

Membership Worker's Record for May

	Personal	Corporation
L. R. W. Allison		1
Paul E. Cox	2	
M. A. Gesner	1	
Ralph E. Hanna	1	
F. A. Harvey	1	
H. A. Huisken	1	
Roy A. Horning		1
Walter M. Hughes	1	
T. S. Mann		1
R. L. McGean	1	
W. G. Owen	1	
W. F. Rochow	1	
Chas. W. Saxe	1	
Mary G. Sheerer	1	
R. R. Shively	1	
F. W. Walker, Jr.	1	
W. W. Wilkins	3	
Office	8	1
	25	4

PITTSBURGH LOCAL SECTION

The Pittsburgh Section of the American Ceramic Society held their regular monthly meeting on Friday evening, May 16, at the Bureau of Mines, Forbes Street, Pittsburgh, Pa. This meeting was one of the most enthusiastic and profitable of any which this Section has held. Following a cafeteria dinner at 7 P.M. the following program was given.

Henry M. Taylor, of the H. C. Fry Co., of Rochester, who is conducting experiments on the dielectric properties of special glass, talked on the development of heat-resisting glass. Examples were shown of high-voltage insulators, sparking plugs and oven ware.

E. H. McClelland, Technician and Librarian of the Technology Department of

Carnegie Library told the members from what source they can follow up this subject at the Library. Mr. McClelland has listed the references on porcelain, among them a number of articles on insulator practice, their design and tests for high voltage currents.

R. E. Arnold, of the Research Department of Westinghouse Electric and Mfg. Company, talked on the development of high-voltage insulators. Mr. Arnold, in conjunction with R. V. Weber of the same company, has had much to do with the development work and tests on insulators and his talk was highly profitable.

The members of the Pittsburgh Section were invited to attend the meeting of the Pittsburgh Section of the American Chemical Society held at Carnegie Lecture Hall on May 22. Harrison E. Howe, Editor of *Industrial and Engineering Chemistry*, talked on "Chemistry in the Nation's Business."

SCHEDULE AND ASSIGNMENTS FOR 1924 SUMMER TRIP

Congregate in Chicago at La Salle Hotel, July 21. Leave 11 P.M. Monday, July 21, on C. M. & St. P. R. R., Union Station.

Spokane, Wash.	July 24. Breakfast, Davenport Hotel. Lunch at Mica. Dinner at Country Club. Local committee will make all arrangements.
Seattle, Wash.	July 25. Arrive 11:45 A.M. Leave Monday, July 28, 11:45 P.M. New Washington Hotel. Banquet in the evening. Local committee will make all arrangements. July 28. Optional trip to Mt. Rainier. Arranged by local Committee.
Portland, Ore.	July 29. Arrive 6:45 A.M. Leave 9:00 P.M. same day. No hotel. Arrangements by local committee.
Lincoln, Cal.	July 31. Arrive 3:15 A.M. Leave 5:20 P.M. same day. No hotel. Arrangements by local committee.
San Francisco, Calif.	July 31. Arrive 10:05 P.M. Leave Sunday, August 3, 11:00 P.M. Palace Hotel. Arrangements by local committee.
Merced and Yosemite	Aug. 4 and 5. Arrive 5:00 A.M. Leave Aug. 6, 8:30 P.M. The hotel and trip arrangements for these three days will be made by the Chicago, Milwaukee & St. Paul Railway Co.
Los Angeles	Aug. 7–13 inclusive. Arrive 7:55 A.M. Hotel Clark. The local committee will make all reservations and all side trip arrangements.
Grand Canyon	Aug. 14. Arrive 8:20 A.M. Leave 7:25 P.M. Arrangements and reservations will be made by the railroad.

Denver, Colo.	Aug. 16.	Arrive 12:00 noon. Leave 7:40 P.M. Arrangements made by local committee.
Colorado Springs, Colo.	Aug. 16–17.	Arrive 10:10 P.M. Aug. 16 and leave 10:15 P.M. Aug. 17. Antlers' Hotel. Arrangements by local committee

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NOTES AND NEWS

BUREAU OF MINES NOTES

Cyanite

Cyanite, a mineral identical in chemical composition with andalusite and sillimanite, but differing in crystal form, has not yet been exploited to the same extent as andalusite, but has many interesting possibilities, states the Department of the Interior, in Serial 2587, recently issued by the Bureau of Mines. Deposits believed to be of commercial importance are reported at a location about twenty miles southwest of Wheatland, Wyoming, and near Charlotte Court House, Virginia. The latter deposit is being developed at present. The commercial possibilities of cyanite are not yet fully known. Like andalusite it inverts to sillimanite when heated to high temperatures, and possibly may be used to produce sillimanite for refractory purposes.

Preparation of Super-Refractories

An investigation having for its purpose the production, by electric furnace methods, of materials of higher refractoriness than those commonly used in commercial practice is being conducted by the Department of the Interior at the Seattle, Wash., experiment station of the Bureau of Mines. Such refractories have been called super-refractories. The first material to be investigated is sillimanite. Two methods of preparing the material are being studied, namely, (1) From a mixture of clay and aluminum oxide in the form of bauxite, diaspore, or alunite residue; (2) From clay alone by removing the requisite amount of silica and the iron by melting with carbon in the electric furnace. The material thus produced in the electric furnace is then subjected to the methods of testing refractory materials and is fashioned into brick and other shapes and given both refractory and commercial tests.

Encouraging progress has been made in this investigation. It is expected that the work on sillimanite will be completed during the present fiscal year and that another material will be taken up.

Spinel

Spinel is a magnesium aluminate occurring in different colors, chiefly red, blue-green and black. Spinel has been found in many scattered localities in small amounts; deposits of sufficient size to have an economic significance are not known to occur. Spinel has never been used commercially except the rare transparent blue and red varieties which have been used as gems.

While the natural spinel has been of little economic value, it is interesting to note that an artificial spinel, produced by synthesis from its compounds displays very interesting commercial properties. This synthetic spinel is made by the combination

of magnesium oxide from magnesite and aluminum oxide from the mineral alunite, which occurs in large quantities at Marysvale, Utah. During the world war when imports of foreign potash were cut off, these deposits of alunite were exploited for their potash content. The mineral was first roasted, rendering the potash soluble so that it could be extracted by leaching. The aluminum oxide content of the residue after leaching was approximately 95 per cent. The synthesis is accomplished by electrical fusion, the spinel appearing in beautifully crystallized masses. This material when bonded in the form of bricks possesses remarkable refractory properties which have made it valuable for many commercial purposes.

Information regarding spinel and various other little known non-metallic minerals is contained in Serial 2587, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

BUREAU OF STANDARDS NOTES

Test for Alkaline Glassware

Recently a proposed test for the detection of alkaline glassware was carried out by the Chemistry Division of the Bureau. The test consisted in heating the sample in an autoclave at 15 pounds steam pressure for one hour. In the case of the best chemical glassware, water held in the beaker was still neutral to phenolphthalein after the test. Other ware gave results ranging from a very faint alkaline solution to solutions which were decidedly alkaline and were accompanied by considerable insoluble matter. In the last-named cases some of the ware was badly etched.

The Bureau believes that this test is satisfactory for the purpose intended.

"Consistency" as Applied to Sluggishly Flowing Material

The following is an abstract of an article on "Consistency" prepared by W. H. Herschel of the Bureau of Standards at the request of Dr. Jerome Alexander for use in his book "Colloid Chemistry, Theoretical and Applied."

In speaking of a material which will flow sluggishly, it is often said that it has the consistency of rich soup or thick cream. Thus the word consistency has a well-known colloquial meaning, and it may be used as a general term when speaking of soft solids and liquids.

It has been found experimentally when testing what may be called true or viscous liquids, that the rate of flow is proportional to the force which produces it. Other materials may flow quite readily, and yet be soft solids or plastic materials which do not show the constant proportionality above referred to.

It is only recently that it has been realized that many common materials, such as paint and mixtures of clay and water, are plastic and not viscous, and much confusion has resulted in colloidal chemistry from the failure to make this distinction. No method of measuring consistency has proved entirely satisfactory for stiff clays and fats, but it is at least possible to determine which materials are plastic, and to measure the plasticity of many plastic materials which are sufficiently fluid.

In cases of doubt tests should be made at more than one rate of flow, and if the numerical results vary, showing that the material is plastic, the attempt should be abandoned to express the consistency of the material by a single numerical value called "viscosity." Two laboratories, by using standardized apparatus and the same rate of flow, may obtain the same "apparent viscosity" for a plastic material from a single test, but it is important to observe that to identify the consistency of a plastic material it is necessary to make at least two measurements at different rates of flow.

Methods and Materials for Lining Tanks with Tile

An investigation is being carried on for the Associated Tile Manufacturers to determine the proper methods and material for lining tanks with tile. During the past month six more concrete tanks have been made. Nos. 123 to 127, inclusive, have been lined with vitreous tile and the corresponding sets of tile bars for transverse strength tests have been made. The grouting cement was a so-called natural cement. Tank No. 119 of this series has now been filled with photographic fixing solution; tank No. 120 with photographic developer; while Nos. 122 and 123 have been filled with sulphurous acid (saturated solution). The effect of these solutions on the linings of the tanks will be studied.

DEPARTMENT OF COMMERCE NOTES

Fourth Reduction in Vitrified Paving Brick Adopted

After having made a comprehensive survey of demands for various sizes of vitrified paving bricks for 1923, the permanent committee on simplification of varieties and standards in that industry met Friday in the Division of Simplified Practice, Department of Commerce, and voted to adopt the fourth reduction in sizes and types since simplification was begun in 1921.

The committee, comprising Will P. Blair of Philadelphia, of the American Society for Testing Materials; Col. R. K. Compton, of New York City, representing the American Society of Civil Engineers and the American Society for Municipal Improvements; Edward E. Duff, Jr., of Cleveland, Ohio, representing the National Paving Brick Manufacturers' Association; Leon C. Herrick of Columbus, Ohio, representing the American Association of State Highway Officials; E. W. McCullough, of the Fabrication Production Department of the United States Chamber of Commerce; E. J. Mehren, of the McGraw-Hill Co., New York City; O. W. Renkert of Columbus, Ohio, representing the AMERICAN CERAMIC SOCIETY and P. St. J. Wilson of the Bureau of Public Roads, Department of Agriculture, found that for 1923 the demand for the six recognized varieties had comprised 80.3% of the total business. The size which was eliminated at today's sessions was found to take up but nine-tenths of 1% of the demand for the same period.

When the paving brick industry first undertook simplification in November, 1921, the 66 sizes then made were cut to 11. At later meetings of the permanent committee on simplification, this number was reduced to seven, and then six, the latter number having stood the test of a year's survey with the results indicated.

This industry was one of the first to seek the coöperation of the Department of Commerce after Secretary of Commerce Hoover initiated the movement for simplification as an aid to American industry. Among the benefits which have been reported through its action are: reductions in cost of production, improved service, and ability to compete more effectively with producers of other types of paving materials.

SOCIETY OF GLASS TECHNOLOGY

The seventh Annual General Meeting of the Society was held in Sheffield on Wednesday, April 16, 1924, the President, Prof. W. E. S. Turner, in the chair. Col. S. C. Halse (Messrs. J. Lumb & Co., Ltd., Castleford) was elected President in succession to Prof. W. E. S. Turner. The other vacancies arising were filled as follows: *Vice-Presidents*, F. G. Clark (Messrs. Beatson, Clark & Co., Ltd., Rotherham), R. L. Frink

(Glass Research Association, London). *Members of Council,* H. A. Bateson, W. R. Dale, J. Moncrieff, W. J. Rees, J. H. Steele, and H. Webb. *Honorary Treasurer,* J. Connolly. *American Treasurer,* Wm. M. Clark. *Honorary Secretary,* S. English. *Auditors,* Ed. Meigh, and Dennis Wood.

The Annual Report and Accounts for 1923 showed that year to have been a happy and successful one. The foreign membership continued to increase, numbering 190 out of 615 at the end of 1923. Of these 109 were resident in the United States. Altogether the Society was connected by membership with no fewer than 17 countries. Prof. Henry Le Chatelier, Paris, was elected an Honorary Member of the Society. A paper entitled "The Physical Properties of Some Alloys Resistant to Heat and Corrosion" was read by J. H. G. Monypenny, and illustrated by lantern slides and specimens. The author dealt with problems which might occur in machinery pertaining to the glass industry, and said there were also certain general engineering uses for material having these special properties, such as the application of the material to various fittings for steam service and hydraulic work.

Dealing first with stainless steel, he outlined the range of properties obtainable, dwelling also on the mechanical and heat resisting properties. Passing on to alloys developed for special properties, the lecturer gave particulars of stainless material in which resistance to mineral acids had been greatly increased, and the tendency for galvanic action in contact with bronze and other copper alloys entirely removed. A short description of some special alloys which had been developed for resisting scaling was given. A sample exposed in a brick kiln for a fortnight, the temperature reaching 1,200 °C revealed a total change in weight of only .04%. The glass industry required alloys suitable for a number of special purposes, in some cases for resisting general corrosion, and in others for resisting the effects of high temperatures. Probably no single alloy would be suitable for all purposes, though for any of those purposes some type of stainless steel would be found useful. For developing any one special property in an exceptional degree, it was generally found necessary to sacrifice other properties to some extent, so that it was advisable for the maker and the user to collaborate.

Mr. W. R. Barclay followed with a paper entitled "Some Properties and Possible Industrial Uses of Alloys Containing Nickel." Illustrating his remarks with lantern slides Mr. Barclay said that he proposed to deal with two alloys, the simple nickel-copper series and the nickel-chromium series, with no other metals added. Referring to the nickel-copper alloys he emphasized their remarkable ductility, combined with considerable toughness and strength, and very considerable resistance to corrosion. A retention of strength at temperatures higher than those at which ordinary non-ferrous metals break down was particularly evident in the nickel-copper alloys containing high nickel. As an illustration of the enormous ductility, he quoted a recent example of material manufactured, in which it had been possible to cold-work a 2 in. bar right down to .02 in. without annealing.

Going on to deal with the nickel-chromium alloys, he pointed out that the two hitherto developed were the 85% nickel, 15% chromium, and the 80% nickel, 20% chromium. They were remarkable materials, bridging the great gulf that had hitherto existed between ferrous and non-ferrous materials, and combining in a high degree the best properties of both. These were the alloys which had made modern developments of electric heating possible. A very important application of them, which the immediate future would see unquestionably, was their use in annealing furnaces where temperatures up to that order were required.

During the morning an exhibition of special steel and non-ferrous alloys, and of tools and plant made from them, was held in the Department of Glass Technology of the University of Sheffield. The following firms exhibited:

Messrs. Brown Bayley's Steel Works, Ltd., Sheffield,
Cronite Foundry Co., Ltd., Tottenham, London,
T. Firth & Sons, Ltd., Sheffield,
Foster Instrument Co., Ltd., Letchworth,
H. Wiggin & Co., Ltd., Birmingham,
T. G. Wolstenholme & Sons, Sheffield.

The President announced that the next meeting would be held in London on May 27th when a joint conference had been arranged with the British Society of Master Glass Painters. They also expected to welcome on that occasion a party of members from France. The Annual Dinner would be held on the evening of May 27th in the Hotel Cecil, London.

A FRENCH MONTHLY REVIEW

A new monthly review was started in November, 1923, entitled *"La Revue Generale des Colloides et de leurs Applications Industrielles."* Hitherto no French publication has specialized in the study of colloids, the importance of which in industrial technic is constantly increasing. Processes resulting from the theory of colloids may revolutionize certain industries now using empiric and routine methods. The development of colloid chemistry being very recent, most of those engaged in industry will be interested in reading this new review. Original articles will appear each month as well as a narrative containing extracts of all the work that has appeared and French, English, American and German abstracts divided into twenty-four classes.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21–Aug.—1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn., Inc.	Oct., 1924	
Am. Society for Testing Materials	June 23–27, 1924	Atlantic City
British Assn. for the Advancement of Science	August 6–13, 1924	Toronto, Canada
Chemical Equipment Assn.	Sept., 1924	
Colloid Symposium	June 19–21, 1924	Northwestern Univ., Evanston, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Manufacturing Chemists' Assn.	June, 1924	New York
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Assn.	Dec., 1924	
Refractories Manufacturers Association	June 23–24, 1924.	Atlantic City
Society for Promotion of Engineering Education	July, 1924	Boulder, Colo.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C.
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh, Pa.
Western Society of Engineers	June 4, 1924	Chicago, Ill.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Vol. 3 July, 1924 No. 7

EDITORIAL

CERAMIC INSTITUTE

A new proposal is this and yet old in its concepts. It is the natural resultant of many factors. Its origin is not easy to trace. Its ultimate pronouncement was by the ceramic industries through their respective trade associations. Its ultimate conception was by those organized groups which have felt its need most keenly. The vision which brought into clearest focus the idea of a Ceramic Institute was that of the ceramic trade associations.

Behind all organized movements there are contributory and immediate causes. These most often in a given case are very different. Among the contributory causes behind this movement for a Ceramic Institute is the general realization of the value placed by manufacturers on exact fundamental knowledge. The immediate cause is the necessity to cheapen manufacturing processes and the urge to better the product.

There is a large gap between the finding of fundamental science facts and the applying of them in the production of wares. The fundamentals are found only by concentrated effort by individuals with very exact and limited purposes. As a rule the fundamentals are disclosed only by the extravagant expenditure of time and the employment of highly specialized ingenuity.

The fundamental investigator cannot work in the shadow of a utilitarian purpose. His whole vision is concentrated on the finding of a single fact.

The unsurveyed fields in sciences of special interest to ceramists are vast, and competent workers few. These are the reasons why manufacturers have for so long a while had no interest in nor felt any obligations to support pure science research.

One employed in fundamental research eventually seeks and finds related facts. This leads through formulation of general laws to their application. This is the manner in which fundamental science facts find a use and become of industrial value.

No one group of persons has a monopoly on knowledge of fundamental facts. No one has exclusive possession of experiences in science application. Collaboration is essential particularly among those who are making industrial application of scientific facts. This is why a ceramic institute is being brought into existence. Its establishment is almost a fact and no doubt will be a fact before the close of the year of 1924. Meetings to this end are being held.

There are problems which can be solved only by expenditure of comparatively large sums and on a scale which would be impossible except through the collaboration of many. Problems of drying and firing of ceramic ware; the survey of sources of materials and their preparation; methods of "winning" raw materials and the devising of means to reduce hand labor in fabrication are problems common to all clay workers. The fuel problems are common to all ceramic concerns. It is perfectly feasible for all groups of ceramic manufacturers to join in support of these investigations on a scale adequate to bring results more surely and quickly.

If 15 to 50% fuel economy is possible without altering the equipment, every ceramic manufacturer should know how and should share in cost of knowing how. It is idle for one group to suppose that it can buy the exclusive right and benefits of an investigation. "The facts will out." The news soon filters through to every concern which has the ability to learn and to use information.

To all who can profit from an investigation should be given the opportunity to so assist in its financing that the investigation may be more thorough and the results be of greater value not only to ceramic manufacturers generally but to each one in particular.

PAPERS AND DISCUSSIONS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY PLAN FOR INDUSTRIAL COÖPERATION[1]

By C. L. Norton

I was greatly gratified when your Secretary was kind enough to ask me to come and talk to you a little while upon the subject of our industrial coöperation scheme which we have been carrying on for four or five years at the Massachusetts Institute of Technology under the somewhat ponderous title of "Division of Industrial Coöperation and Research." I am particularly pleased to be able to talk with you about it as I think this is the first formal public utterance that we have made in the last four years in regard to the real working of the plan.

I am sorry that there seems to be no way of finding in whose mind was the original conception of this idea, but it certainly is true that to Dr. W. H. Walker, at that time Professor of Industrial Chemistry at the Institute, and now non-resident professor, was due the motive power to drive the thing into actual existence, and to his original ideas in collaboration with the late President MacLaurin the scheme owes its origin.

In a general way we were in the throes of an endowment drive and the scheme had a somewhat erratic beginning in connection with that, but in substance the idea was to secure the coöperation of such industrial companies as were interested in research and to set up a coöperative scheme whereby they would pay us a certain amount of money annually and we in return would do certain things for them.

The initial set-up involved contracts with about 225 companies, varying from some of the very largest industrial concerns to those of small size, including a considerable number of trade associations about which we have so interestingly heard this morning, and lasting in most cases for five years and involving a total amount of about one million and a quarter in payments over the period of five years.

The services which we undertook to render were of three kinds. In the first place we were to do all that we possibly could to determine the location and the qualifications of such personnel as it might seem desirable to add from time to time to the staff of the various contracting companies. That is, if they wanted engineers or scientists for any particular purpose, we were to maintain such index and files, etc., that we should be able to find them when wanted, whether for an occasional service or for regular employment. I think I may say that we have been extraordinarily successful in this personnel branch of our work and its scope has gone far beyond the two or three hundred original contractors and our bureau is re-

[1] Presented at the Atlantic City Meeting, Feb., 1924 (General Session).

ceiving inquiries for men of all sorts of unusual and occasional services as well as for expert and scientific advice and service in matters of prolonged research or permanent employment.

The second term of our agreement was to furnish information from our libraries and files with other collaborating libraries, and such scientific information as we could without prolonged research, and to compile bibliographies, etc., or as Dr. Walker used to say, "to furnish to the contractors on demand any information that anybody on the staff had under his hat." That is, it was not research, it was not long investigation, but as a rule the reply to the occasional question—the search for brief bits of reference, etc.

This reference work has also grown greatly although, of course, you realize that there are a good many other organizations carrying on similar service.

But to the third, and in my opinion, our primary function, was the planning and direct control of research and the study of problems, either small or large, and the digging out of problems by plant visitation, and by consultation work by those who were actually engaged in industrial operations.

That was the plan. That was what we undertook to do. Perhaps it is interesting to look at its present status at the end of four years of trial. Let us see just what happened to the Institute itself in that connection.

As you probably know we have an institution containing from three thousand to four thousand students, running nine months in the year in regular academic fashion with a pretty active series of sessions running throughout the summer, and a staff of some four hundred people devoting their time mainly to the training of young men. Our main business is, has been, and I hope always will be, teaching school. It is to train young men to be scientists and engineers, rather than to aid industry. And with that in mind let us see what happened to the Institute as a result of our coöperative industrial work in the last four years.

Without exception, every contact the plan has had with the Institute has been helpful. The contact of the staff and the contact of the students with outside practical men with very definite problems has been without any question of great help. Further, we have discovered that instead of being a group of fifteen departments, it has become one great group devoted more nearly to the same purpose than it ever was before. This is the first reaction of the Technology Plan.

We have endeavored to carry on all the research work which has come in under the plan with the actual members of the teaching staff. There has been no serious attempt made to add a research unit. What comes to us is in my opinion better handled by the expert scientists and engineers, the men who have attained distinction as teachers and in the capacity

of researchers, rather than to build up a group of young men who might devote their whole time to research. What we are doing as the load increases is to increase the number of teachers and to increase the time which each man may devote to research and development under the coöperative plan and very materially, therefore, increase the total staff.

It has been said that that effort of coöperation is to make our industrial work a sort of by-product of our educational work, and as such it seems to have produced a by-product of unusual value if we may judge from the reaction upon the Institute.

I believe also that the plan is a very definite and forward step in modern education, although perhaps it is of not as much interest to you who are practically concerned with ceramics at the moment, as it is to us whose business it is to teach, but it will ultimately be of some interest, because it is upon the men which institutions like ours turn out that you have to depend more and more as the work of the ceramist and engineer generally becomes more highly specialized.

If you will go back fifty or seventy-five years you will find that all our higher educational institutions taught by book and blackboard and very little else. Along about the time of the Civil War the laboratory method began to be developed and we find a number of institutions beginning to teach physics, chemistry and elementary engineering by the laboratory method. We have gone on for about seventy-five years increasing our specialization but generally conceding that no one can teach applied sciences and technology satisfactorily except by a robust and definite laboratory method.

We have now come to a third stage of development where we must have in the great technical institutions something besides its own laboratories in which these elementary subjects can be taught. It is all very well if we are to teach ceramics for us to maintain chemical laboratories, physical laboratories and laboratories of heat measurement, etc., but in order to know what is going on, if I see this vision aright, we must have somewhere adjacent small ceramic units, kilns which may be operated and controlled, grinders and mixers, and all sorts of things that go into the elementary stages of the art in considerable measure. I believe that our coöperation with an industry, if it only brings to the educational institution more and more such practical work, will enable us much more nearly to meet some of the very wise criticisms which your President made in his opening address. I have run several factories myself, and I agree entirely with his suggestions as to the limits of utility of the extremely recent technical graduates.

The advertising value of our coöperative plan to the Institute has turned out to be very great, although it was quite incidental to the general plan. Wide publicity has been given to the plan and the struggling inventor;

the man with an isolated or somewhat unusual plant, even in a very remote part of the earth, has discovered that a technical institution of good standing has attached to it a sort of point of contact to which he can go, not as a matter of courtesy or privilege but as a matter of regular routine business. He may bring his particular technological and scientific questions or difficulties to the attention of somebody who may be able to help him.

I think you can have no realization of the extent to which this contact has developed in the last three or four years. It has made us an enormous number of friends in remote places which we had never been able to reach, and has been able to make us of service to quite as many people who are not regular contractors under this plan, as those who are.

Leaving our own affairs for a moment let us see what appears to be the reaction of this plan upon the industries generally which have been associated with us. Perhaps you can visualize the thing a little more clearly when I tell you that of the 200 odd contractors there are some of the larger steel companies, companies interested in the manufacture of refractories, a large number of textile people, those making rubber tires, and makers of heavy chemicals, and some of the great testing laboratories whom we expected to be our competitors, but which have proved to be our very best friends, and a large number of small manufacturers whose circumstances are such that they cannot maintain their own research laboratories.

From representatives of this group we have endeavored to find something about the reaction of the plan. There are some people who use it very little; we can get practically no response from them upon matters of research. They use us only as a sort of industrial insurance to be resorted to only in unusual circumstances. Then there is another group that use it only when they get into trouble. They keep a contact with us very much the same as they might carry industrial insurance, so to speak. They have their own research laboratories, and very likely have a staff for the particular service they are interested in, quite as well planned and perhaps more skilful than ours upon any such matters as are likely to come up in their routine business, but occasionally either from new developments or from accidents or from matters of controversy between different members of the trade association, etc., we are called in by them on unusual industrial problems.

With others we have an active daily contact. We are in as close touch with some of these contractors as we would be if we were their individual laboratory at their own plants. For them we are working on incidental problems but preferably carrying out long and fundamental researches.

It has been our effort to avoid the things which clutter up a research laboratory so readily—the routine testing, which is perhaps quite as well done by other people in other places, and to confine ourselves to the longer researches in fundamental matters, as far as possible. Investigations of

some three or four years' duration involving as many as twelve men at a time upon one problem have been the sort of thing which has been brought to us by these types of contact.

A curious process is going on all the time, of course. We are in a way losing our customers. A man comes to us with a particular problem and we tackle it, perhaps with a reasonable degree of success. He either takes our experimenter away from us and puts him to work in his own plant, or asks us, as has been done a very considerable number of times, to equip him with his own laboratory and get the thing going and find the men and set them to work.

I said that we were losing our customers. It did for the moment seem to be the end of the contact in a number of cases, but almost invariably they come back and bring to us the fundamental and unusual problem which the routine research laboratory of their own plant or industry finds difficult to handle or too ponderous for the somewhat limited equipment. You will realize that if we can keep these researches and investigations in our own plant they are not interfered with by the operating man who is so frequently telling the research laboratory that it can or cannot do this thing or that because of the breakdown such and such a unit has been noted or the control study of some other one has been completed. That is, prolonged research is saved from interruptions in our hands whereas if it is in pretty close contact with the plant such interruptions become a constant source of annoyance.

Frequently, we have been able to return to the contractors very much more in a monetary way than either we or they had any reason to expect. Even though their research laboratories are highly developed, we are frequently able to carry on investigations more satisfactorily than they can and the reason is this: We have a group of some three hundred or four hundred men, all specialists in their own lines, all working upon the science or the technology of the moment and because of the necessities of their teaching, perfecting themselves just as rapidly as they can in some line or other. They have a very large modern laboratory equipment, the whole of which is available a considerable portion of the time for things other than the work of teaching. That is, both plant and equipment have given us exceptional opportunity for undertaking problems for which the ordinary plant laboratory would have to equip itself especially. We are doing very profound and prolonged research for some of the largest of the world's research laboratories, they having made transfers to us from time to time, possibly to take them back when they have been developed and enlarged to the point where they have outgrown our province.

Of course, we have exceptional luck at times with investigations of this sort and I think I might be permitted to tell you a story of one of our contractors who was most profoundly unhappy as to the termination of a

development on a machine which absolutely refused to operate properly after a long and weary investigation as to its structure and general behavior. They came to us and asked us if there was anything we could do.

Not knowing the nature of the problem, one of my associates went down to see what it was all about. It was explained to him in considerable haste. It turned out that the trouble was due to a cumulative film which was gradually being deposited upon the surface of some of the working parts and which yielded not at all to some of the extraordinary solvents which were put on over and over again.

After looking at it for a while, this man who is a theoretical chemist of some considerable distinction, asked if they had ever used soap. They said "No." The materials which they had used, it seemed, would do anything that soap would do and a great deal more, so it was absurd to try soap.

He said "Would you mind sending out for ten pounds of powdered soap so that we may try it?" Rather reluctantly it was sent for. The soap worked like magic, and the trouble was ended and the machine worked in a perfectly satisfactory manner.

They wanted to know how he happened to use soap. It so happened that our representative is a real expert upon the subject of soap. He knows much more about soap than most chemists. He said there was no magic and no theoretical chemistry about it, however, but that he got some of the stuff on his hands when he handled the machine and noticed that it readily came off when he washed his hands with soap. Now that in a way was pure luck, but our general technical staff is frequently focusing its attention upon problems quite as definite as this, and a stranger from the outside whose business has been to look broadly at the problem (I have in mind at the moment some of your ceramic problems too) has a perspective which is a great deal better than that of the fellow who is getting down in the noise of the grinding pan or in the muddiness of some other operation and is not able to see the thing quite in the proper dimensions. It is in that way that we have helped many of the big laboratories by furnishing men to take a new and rather fresh general view instead of a highly specialized one.

Perhaps you might be interested in knowing what sort of things are at the moment going on in the laboratory. You will bear in mind that the entire great plant and equipment of ours is our research laboratory, it having been generally agreed after some years of struggle that the whole institution is itself a research laboratory and that the men who teach shall in most instances be the men who do the research. There may be some adjustment of time between the two in different instances, since some men are born teachers and others are born researchers, but the division of the work is the general policy we have been adopting so, if we need to, we can

usually get any man of the entire staff to put upon any problem and can give a reasonable amount of elasticity in his teaching schedule to permit it. I have yet to hear from the students that any one of the men we are using has been neglecting the teaching work.

Now as to the research which will perhaps indicate somewhat the scope of this work. We have gone into a long study of the effect of low dielectric insulation in preventing cable breakdowns. A second investigation which has been going on for some time and which terminated recently in a very satisfactory manner, is the determination of the nature of the caustic brittlement of steel. When you stop to think that a piece of boiler plate ordinarily tough and firm and strong may, under certain conditions of use, become exceedingly brittle, it leads one to think a little bit about the rigidity and permanence of boiler structures subjected to caustic soda, and the investigation of this peculiar and insidious action of caustic solutions upon steel has been carried on by us for one of the contractors for about five years and employs at times four or five men. The results of this investigation are now being printed.

We have researches upon the subject of refractories about which we are unable to say much since they are development work carried on for individual concerns. Some of them have progressed to the point where actual production of the finished material has begun apparently with considerable satisfaction, and promise of commercial success.

We also have another group of men studying the heat transfer in gas pre-heating stoves and similar devices.

We are carrying on an investigation of food values of certain cattle foods.

We are studying problems in compounding rubber, both questions of a mechanical sort and also of substitutes and alterations and accelerators.

It has been possible to get together enough manufacturers upon some of these problems to have a fairly definite group rather than to depend upon isolated support.

We are beginning again a long fundamental search for the causes of corrosion of steel, having been given funds enough to carry on that work which we have been doing more or less in an interrupted fashion since 1897.

We also have a group of men working upon a purely scientific problem—the determination of thermodynamic properties of steam at turbine pressures.

We are studying the thermal conductivity of refractories and insulating materials, and just now finishing an investigation of the thermal conductivity of refractories of very high temperatures, and I think we are in a position at last to get some clear notion of their thermal conductivity right up to the point where they are no longer able to carry loads.

Another investigation is the study of the discoloration of chocolate candies.

All through this list I have avoided, as being, perhaps, of less interest to you, those problems which are problems of what we call *pure* scientific research. I do not know exactly what that is; I have never found anybody who did know exactly, but where a man goes hunting scientifically after something that he believes is there, hoping to find out what it is, we call it pure scientific research. If he goes after something he knows is there but does not know whether he can get it or whether it is of any use, we are inclined to call that research applied to a definite purpose or definite problem.

But with all the research activity the country over, such as Dr. Howe has just described to us in his paper on the activities of trade associations,[1] and also with the activities of the government bureaus and all the universities, you can see that we are doing a great deal of work upon the technical problems, the things that interest us for the moment, but we are doing altogether too little work upon the things which lie back of all the investigation, or fundamental problems which are more often matters of pure physics or chemistry.

As one of the wise men of the research field told me the other day—"If we don't watch out we are going to find ourselves all dressed up and no place to go"—we are going to run out of fundamental information and problems.

You and I and all of the men in this industry have got to begin to study a little more about the fundamental behavior of silicates, the precise determination of what constitutes the reaction that goes on in the fundamental bodies we are working with, whether it is refractories or glazes, or the fifty-seven other things which you know about, and I cannot even name. We shall soon find that we must study the fundamental problems, otherwise industry is going to be pretty abruptly at a standstill in comparison to the progress which it has made in the last ten years in research of this kind.

I give it to you as a thought that I hope you will carry away with you because it is the influence of the practical men associated with industry that has kept this development back. Their unwillingness to attempt the problems of physics, geology, chemistry, etc., as they relate to industry has delayed things quite a little and your hearty coöperation in letting this youngster or that one or perhaps an older man devote his time to some problem in *pure* science is going to be the leaven that perhaps will bring to your industry some great return.

In conclusion, I am asked by our President, Dr. Stratton, formerly, as

[1] See *Bull. Amer. Ceram. Soc.*, **3** [6], 209 (1924)

you know, at the Bureau of Standards in Washington, to state most positively that the work which we have long been contemplating, the establishment of a course in Ceramic Engineering at Technology, has reached the point where we are going to put it in operation. Our quandary has been this: just exactly how to do it. We trust that we may receive suggestions and advice from the members of the SOCIETY.

ADDRESS ON TERRA COTTA[1]

BY WILLIAM H. POWELL

It may be of interest to consider very briefly the relation of the ceramist to the terra cotta business, particularly as to the development of that relation since ceramists were first employed in terra cotta work.

While the ceramist has come to have many duties in the terra cotta plant, primarily he is supposed to be responsible for bodies, slips, glazes, and firing conditions.

The first terra cotta ceramist I knew was an English glaze mixer. He compounded glazes behind closed doors and retained personal possession of the formulae. He produced what was apparently very satisfactory cream glazes as well as a few other colors, such as greens, tans and blues, all burned at about cone 7. Somebody discovered that this cream glaze he was making could be sand-blasted, producing a very beautiful matt surface—which Stanford White, the distinguished architect, once described as having a bone-like texture, more closely resembling elegant marble than anything he had ever seen. So far as I know, this was the beginning of the use of glazed terra cotta in the east.

This mixer had nothing to do with the composition of the body—which appears to have been left in the hands of others—and such clays as were used were selected more on the basis of expediency than for consideration of permanence, although it may be a question if any doubt as to permanency arose in the mind of anyone.

Unfortunately, our friend the mixer was found dead in bed one morning, and he took his recipes with him. His employer had a very hard time of it for awhile. I think that was about the end of one-man knowledge in the terra cotta business.

Shortly after his death the specially trained ceramist began to appear in the industry and the manufacture of glazed terra cotta gradually became quite general.

During the early years in most companies the ceramist had very little to do with the composition of the bodies and nothing very much to say as to the selection of clays. He used what was given to him, and if he ever

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Terra Cotta Division).

had any doubt as to the propriety of using what was given to him, that is, from the standpoint of permanency, he managed to conceal that fact very successfully from those who were in daily contact with him.

One of the very early men conceived the idea of firing both glazed and unglazed terra cotta at cone 2 and some very beautiful effects were produced. Unfortunately, the glaze was apparently immature and crazed badly, and the body, which ought to have been fired around cone 7, of course, was quite different at cone 2 and a great deal of material sold showed very serious disintegration in a few years. Another ceramist I knew of thought it would be a grand idea to stop the crazing of a glaze, which happened to be very popular at that time, by "opening up" the body, as he called it. I think he was right so far as that particular glaze was concerned, and it did correct the difficulty, but the terra cotta went to pieces when used for parapet or free-standing work above the roof line.

Possibly fifteen years ago the ceramist began to be called upon to become responsible for the body but the subject appears to have been attacked first from the standpoint of shrinkage, and it was not until later years that the matter of disintegration, which occurs at times in so-called "free standing" work, particularly with glazed ware, forced itself upon the attention of both manager and ceramist.

This unfortunate defect has undoubtedly created a certain amount of prejudice against terra cotta. It is not my purpose at this time to engage in any discussion as to the possible causes of this destruction. The Bureau of Standards began an investigation of this subject in 1917 with some interruption during the war period, and it has not reached the end yet. It is my hope that the Bureau will eventually make some definite pronouncement on this subject, even if only as to general principles, which will be accepted by all as having back of it the weight of scientific authority.

In the meantime, of course, while we are waiting for the Bureau to say something on the question, there is nothing to interfere with any ambitious ceramist solving the problem for us.

I suppose that you are all familiar with the standard specifications for manufacture, furnishing, and setting of terra cotta, recently adopted by the National Terra Cotta Society after several years of work by a committee in conference with a committee representing the architects.

I should like particularly to invite your attention to the glossary of terms relating to terra cotta which appears in this specification and which represents the official definitions as adopted by the manufacturers. I think it would be useful and very helpful if the ceramists in their literature would adopt this nomenclature in order to secure uniformity.

There are some minor problems that relate to quality that, of course, ought to have attention; for example, the development of a satisfactory patching cement which could be used with equal facility at the factory

or the job when necessary and which would retain its color and strength.

Some years ago, I think two or three, the Terra Cotta Division appointed a committee to take up this subject. I believe that the committee has been unable to get very far. It is an important matter and something that ought to have attention.

Some one ought to develop a solution which would readily clean unglazed terra cotta on which soot has been deposited. Chemists tell me that that is not very easy to accomplish but it would be an important object to effect satisfactorily.

I should like very much, if it were possible, for the Terra Cotta Division of the American Ceramic Society to become attached in some way to the National Terra Cotta Society. I do not mean that it should be detached from the Ceramic Society but I think a way ought to be found to tie more closely the two associations which are supposed to stand specifically for the advancement of the industry of which members of the Terra Cotta Division represent such an important part. As a first step in that direction something might be accomplished if the members of the Terra Cotta Division attended the meetings of the National Terra Cotta Society. If it did nothing else, it might add a little more dignity to the meetings of the National Society.

In an industry like ours, which is half artistic and half commercial and where the operations are substantially all hand processes, the greatest care must always be taken to produce quality. Eternal vigilance is the price of safety. In a business like the terra cotta business there never should be any let down in quality. Price to the consumer rather than the welfare of the industry is an erroneous criterion. We ought to have a decided advantage over natural products because terra cotta permits of complete control in manufacture, while stone must be used as it comes from the quarry.

To my mind, of all the possible qualities of terra cotta which may be developed, the one of permanence transcends that of all others. The colors, textures, or kinds of ceramic finish are in a sense factors of minor importance which are comparatively easy to work out but which are of no use whatsoever unless permanence of body can be guaranteed. We must produce a terra cotta which, whether glazed or unglazed, shall be permanent and indestructible under any and all climatic conditions in any section of this country and with no limitations as to its use so far as permanence is concerned in practically any form of architectural decoration.

350 Madison Ave.
New York City

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?

2. What difference is there between the properties of a soft mud machine made and a hand made brick?

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Note: It has been suggested by some of the Question Box readers that the matter of grog sizes and content in brick mixtures should receive some attention by this Department. Undoubtedly considerable interest in the effect of various grog sizes and grog contents, on brick service, exists.

It will be noted in the previous discussion on the effect of coarse grinding that no definite behavior can be ascribed to various grain sizes with clays in general. In specific instances the behavior is known to some extent.

The chemical composition and the physical characteristics of the clays employed dictate the grinding treatment and grog content and the problem is almost entirely local.

Inasmuch as there is an outspoken request for detailed information on this subject a call is issued herewith for questions and discussions on this subject. State questions carefully. Confine them to specific clays. Contribute a short discussion of each question if possible, submitting screen analyses, spalling tests and service characteristics. Further discussion will be solicited privately by the Editor.

The compilation of such detailed data will be of considerable value. Loose discussion of carelessly worded questions dealing only in generalities does not meet the purpose of this Department. Any such material submitted will be dealt with Editorial license.

Additional questions on manufacturing and service problems of all classes of refractories are solicited. State questions clearly, make them specific and accompany each one submitted with a short discussion if possible.

If you have any information on any of the questions which have been discussed or those listed for later treatment send it at once to the Question Box Editor c/o The General Secretary, Lord Hall, O. S. U., Columbus, Ohio.

Laboratory Control and Refinement of Process

In the May number the problem of laboratory control[1] was discussed from several angles. Since the publication date there has come to the Editor's attention a novel arrangement which will aid materially in securing uniform mixtures of several batch ingredients and may also assist in the tempering of these mixtures. The description and cuts shown here were originally sent out to some of the customers of Sandvik Steel, Inc., announcing the development of the apparatus, a steel belt being used as the conveying medium. The use of this piece of equipment in connection with present layouts might solve the problem of

FIG. 1.

uniform mixtures more easily than any of the methods now in prospect. We print here the material furnished at special request together with an extract from a letter.

It appears that installations now in use are serving dry press machines but there is no reason why the feed could not be diverted to one or more pug mills after the thorough mixing had been accomplished.

Mixing and Distributing Belt Conveyor

An interesting piece of equipment for brick plants—a mixing and distributing belt conveyor—has been developed and was installed in several plants in England last year.

[1] *Bull. Amer. Ceram. Soc.*, **3** [5], 162–68(1924).

Fig. 1 shows the general arrangement. A flexible steel belt is used as conveying medium and material is handled on both runs. The screened material is delivered from several bins onto the upper run in layers one above the other. Immediately after the last feeding point there is arranged a series of plows which turn the material over and over. Simultaneously the mixture is sprayed with water by compressed air operated atomizers. It undergoes a final mixing on being plowed off the upper run of the belt and falling down a chute onto the lower run, which thus carries a thoroughly mixed material. The amount required

Fig. 2.

by each press is plowed off at the proper place by means of an adjustable plow, Fig. 2.

This mixer-conveyor thus performs a three-fold duty, conveying, mixing and dampening, and its location is immediately in front of the presses, the idea being to supply all the presses with a perfectly uniform material, regardless of the irregularities in each separate bin. The result of this mixing is a much improved product, practically consistent in size, shape and color. Pressure on the presses is less and uniform throughout the year, consequently power consumption and upkeep are much reduced. This conveyor also requires much less power and maintenance than several conveyors previously used for the same purpose.

It further serves the purpose of inter-connecting the machines, making the presses independent of the failure of one or more grinders, as long as the remaining grinders in the battery have sufficient total capacity to supply all the presses.

It is recognized that the steel belt is the only conveying medium that will satisfactorily accomplish all these duties and resist the considerable amount of plowing required.

Units of this kind are in operation in a number of plants abroad and are reported to be giving unprecedented satisfaction. In fact this application, as described in attached writeup, is considered a most important step forward in the manufacture of brick. The London Brick Co. are using quite a number of this type of conveyor throughout their plants. The first unit has been in operation for over a year and it is reported that maintenance expense during that time has been nil except for occasional lubrication.

Question

What specification limits should be considered reasonable on 9-inch fire brick? On special shape brick?

Discussion

Nine-inch Series Allow one-sixteenth inch over or under the standard thickness dimension of two and one-half inches. This means that ten brick piled up may vary between twenty-four and three-eighths minimum and twenty-five and five-eighths maximum.

In length each brick may vary three-sixteenths of an inch over or under the standard dimension.

In width each brick may vary one-eighth of an inch over or under the standard dimension.

Shape Brick Unless special limits of tolerance are shown on the drawing, no dimension should vary more than one-eighth of an inch over or under that shown, excepting that brick having a dimension exceeding six inches may have a variation in proportion to one-fourth of an inch per foot.

The dimension and face which should be most perfect may be so labeled on the drawing.—E. N. McGee, Semet-Solvay Company, Syracuse, N. Y.

The matter of variation in fire brick sizes presents a distinct problem to the designer and builder of furnaces. Allowance must be made in the design of each type of installation and experience must enter into the computation of the amount. The discussion above shows the experience of one designer, and while it applies in some measure to other problems, it cannot be taken as having a universal application. The American Society for Testing Materials adopted early this year a set of tolerance

specifications which are now practically obsolete on account of at least two manufacturers having placed fire brick on the market which do not vary measurably in any one dimension. One of these manufacturers produces a brick which is understood to have as little variation in thickness as one-ninety-sixth of an inch in two and one-half inches, or less than one-sixteenth inch per foot.

The matter of variable dimension is perhaps of slightly less importance than shape, a true surface and square corners being necessary to insure good brick laying. Warpage is common in all fire clay goods made by any process other than the dry press method. This warpage, while slight in standard sizes, is of some consequence in the case of special shapes and tile. The fault lies in the methods of handling, careless workmen and some of it is traceable to unequal distribution of moisture and erratic drying methods, while a portion is the natural result of poor setting or inadequate kiln furniture. Every manufacturer seems to be studying these problems more or less with respect to his particular needs and it is safe to say that uniformity of size and shape will soon be the rule and not the exception as now.

Question

What difference is there between the properties of a soft mud machine made and hand made fire brick?

Discussion

As a rule I think there is not a great deal of difference between brick made in these two ways.

However, as the brick are usually made we have found that, other things being equal, the soft mud machine 9-inch brick, weighing approximately seven pounds, will be three to four ounces lighter in weight than a hand molded repressed brick. A hand repressed brick must be stiff enough when it is repressed to be handled with paddles, whereas a soft mud machine brick could not be so handled.

Therefore, the soft mud machine brick is a little more open in structure than the hand repressed brick, and we have found that it behaves slightly better in the spalling test.

The hand made repressed brick generally presents slightly smoother faces and sharper edges because it is pressed in a steel box, where the other brick is made in a wooden mold. However, because these brick are handled when pressed and still a little soft, and because of the methods used in piling or placing them for drying they do not seem to lay up any better than the soft mud machine made brick, which is not touched by hand until set in the kiln.—S. M. KIER, Pres., The Kier Fire Brick Company, Pittsburgh, Pa.

Without doubt the only difference in the material from which the two types of brick mentioned above are made is the moisture content. The difference in spalling behavior may indicate one means of improving the behavior of certain other brick when coarse grinding is not desirable or effective.

A study of the permeability and of the resistance to slag penetration and erosion of the two types of brick made from the same material would be of interest. Anyone having information on the subject is requested to forward the same to this department.

ACTIVITIES OF THE SOCIETY

NEW MEMBERS RECEIVED DURING MAY 15 TO JUNE 15

PERSONAL

Brandow, Glen A., 69 W. Gibson St., Canandaigua, N. Y., Lisk Mfg. Co.

Brooke, Frederick H., Oughtibridge, Sheffield, England, Managing Director, Oughtibridge Silica Fire Brick Co., Ltd.

Caldwell, John A., Box 1, Frostburg, Md., President, Savage Mountain Fire Brick Co.

Connors, Frank J., J. H. Gautier Co., Jersey City, N. J., Sales and Research.

Daeves, Karl, Phoenix A.-G., Hauptverwaltung, Düsseldorf, Germany, Director of Research.

Decker, Lewis T., 816 Carteret Ave., Trenton, N. J., Assistant General Manager, Independent Brick Co.

Forbes, George A., 615 Clyde St., Pittsburgh, Pa., Sales Agent, General Refractories Co.

Gill, Francis D., Gill Glass Co., Philadelphia, Pa., President.

Goddard, Harry E., Route 1, Box 627A, Richmond, Calif., Chemist, Pacific Sanitary Mfg. Co.

Haupt, C. H., Standard Oil Co., General Engineering Dept., Elizabeth, N. J.

Lalor, Morgan D., 811 S. Union Ave., Los Angeles, Calif., Mechanical Engineer, Los Angeles Pressed Brick Co.

Lamb, Roland H., 305 N. Holiday St., North East, Md., Mechanical Engineer.

Robinson, George R., Hocking Valley Brick Co., Nelsonville, Ohio, Assistant to Manager.

Sheehan, P. J., E. Park Ave., Niles, Ohio, Vice-President and General Manager, Niles Fire Brick Co.

Taylerson, Ewart S., 1410 Frick Bldg., Pittsburgh, Pa., Engineer of Tests, American Sheet and Tin Plate Co.

Thompson, Henry M., Room 516–9, S. Clinton St., Chicago, Ill., President, H. M. Thompson Co.

Weinfurtner, E. M., Ashland, Ky., Treasurer, Ashland Fire Brick Co.

Wykstra, Gerritt E., Michigan Porcelain Tile Works, Ionia, Mich., Superintendent.

CORPORATIONS[1]

J. A. Bauer Pottery Co., 415 West Ave. 33, Los Angeles, Calif., W. E. Bockman, President.

The Owens Bottle Co., 1401 Nicholas Bldg., Toledo, Ohio, S. S. Cochrane, General Factories Manager.

MEMBERSHIP WORKERS RECORD

	Personal	Corporation		Personal	Corporation
Abel C. Cameron	1		H. H. Sortwell	1	
C. E. Fulton	1		E. Ward Tillotson	1	
J. H. Gautier & Co.	1		H. B. Tyler	1	
J. Holland	1		Thomas C. Walker, Jr.	1	
W. G. Owen	2		A. S. Zopfi	1	
W. A. Potter	1		Office	5	1
John Sawyer		1		—	–
R. R. Shively	1		Total	18	2

[1] NOTE: *Bull. Ceram. Soc.*, **3** [6], 238, The Ceramist Corporation address is 17 Roseville Ave., Newark, N. J., not Trenton, N. J.

Our Membership Record for June

Holding in the line. Penalty, more work. Eighteen persons, 2 corporations and 1 renewal is the gross increase for June. Thirteen resignations by persons who are no longer in ceramics makes the net increase only 6 persons and 2 corporations.

This is the worst record yet. Are we down-hearted? No!

Are the members going to push stout-heartedly on until all will be participating in this self-educational enterprise? Yes!

How do we know? Knowledge is the foundation stone of industrial advancement.

The 1924 Monthly Gross Acquisitions

	Personal	Corporations	Total
January	31	6	37
February	40	8	48
March	29	0	29
April	35	3	38
May	25	4	29
June	18	2	20
	178	23	201
The gross acquisitions from January to June were	265	33	298

The Net Roster

	Personal	Corporations	Total
Net Roster May 14	1831	291	2122
Resigned	13		13
	1818	291	2109
Renewal		1	1
New Members	18	2	20
Net Roster June 14, 1924	1836	294	2130
Net Roster June 14, 1923	1792	238	2030
Net Gain since June, 1923	44	56	100

CHANGES OF ADDRESS

The following members of the Society have requested that their mailing address be changed to the addresses here given.

A. R. Anderson, Mayfield, Ky.
Yngve R. Anderson, Dominion Fire Brick and Clay Products Co., Ltd., Moose Jaw, Canada
E. E. Ayars, Box 103, Coconut Grove, Florida
William G. Bergman, Toledo Engineering Co., Box 6, Sta. G, Toledo, Ohio
Edward Burkhalter, 80 Thirteenth Ave., Columbus, Ohio
M. W. Butler, 1775 Cliffview Rd., Cleveland, Ohio
B. F. Cake, Los Angeles Pressed Brick Co., Frost Bldg., Los Angeles, Calif.
Arthur D. Camp, Box 904, Niagara Falls, N. Y.
W. W. Coates, Jr., Carrs Station, Ga.

S. F. Cox, Diamond Power Specialty Corp., Oakland and Caniff Sts., Detroit, Mich.
R. S. Finney, North American Clay Co., President, 303 W. 80th St., New York, N. Y.
L. J. Frost, Vitreous Steel Products Co., Nappanee, Ind.
Hugh S. Gallagher, 307 Wabash Bldg., Pittsburgh, Pa.
R. F. Grady, Jr., 5811 Manchester Ave., St. Louis, Mo.
John R. Green, 1615 Sherwin Ave., Chicago, Ill.
Walter McK. Hughes, 334 Putnam Ave., Zanesville, Ohio
Otis L. Jones, Illinois Clay Products Co., Barber Bldg., Joliet, Ill.
R. B. Keeler, c/o California Clay Products Co., South Gate, Calif.
Walter A. Koehler, 1611 Chadbourne Ave., Madison, Wis.
F. M. Koenig, Washington St., Carpentersville, Ill.
P. William Lee, 217 W. 15th St., Chicago Heights, Ill.
W. M. Legnard, c/o Interstate Clay Products Co., 160 N. LaSalle St., Chicago, Ill.
E. H. Lintz, 1117 McKinley Pkwy., Lackawanna, N. Y.
Charles Laird, 102 Lake St., Ashtabula, Ohio
C. F. Miller, University of Washington, Law School, Seattle, Wash.
J. A. Nagle, Brunt Porcelain Co., Chaseland, Columbus, Ohio
Clifford H. Parmelee, R. F. D. 1, Warners, N. Y.
J. G. Phillips, 515 Cottage Ave., Piqua, Ohio
E. E. Pressler, 311 Essex St., San Antonio, Texas
Lemuel V. Reese, Erie City Iron Works, Erie, Pa.
H. P. Reinecker, Lynwood, Los Angeles, Calif.
Wallace C. Riddell, 306 New Call Bldg., San Francisco, Calif.
Samuel Rusoff, 231 Hudson St., Tiffin, Ohio
N. L. Schneider, 2004 Union Trust Bldg., Cleveland, Ohio
W. J. Scott, 324 N. Waller Ave., Chicago, Ill.
L. I. Shaw, Western Electric Co., Hawthorne Station, Chicago, Ill.
Charles A. Smith, 1150 Oak St., Columbus, Ohio
Charles H. Stone, Jr., Box 274, Rome, Ga.
Paul Teetor, 911 Edgewood Ave., Trenton, N. J.
Erwin F. Theobald, General Delivery, Bessemer, Pa.
Leo Thurlimann, 341 S. Springfield Ave., Chicago, Ill.
Martha Q. Westfeldt, 633 Royal St., New Orleans, La.

EASTERN SECTION MEETING

The Summer Meeting of the Eastern Section of the AMERICAN CERAMIC SOCIETY and New Jersey Clayworkers Association was held at the Trenton Country Club, Trenton, N. J.,on June 20, 1924. The meetings were presided over by the President of the Association Charles F. Crane. At the morning session Ross C. Purdy, General Secretary of the AMERICAN CERAMIC SOCIETY of Columbus, Ohio, gave an address on "A Ceramic Institute." At the afternoon session the following addresses were given: "Proposed Investigation by the Bureau of Standards in the Whitewares Field" by R. F. Geller, of the Bureau of Standards, Washington, D. C.; "Fundamentals Underlying Everyday Drying in the Ceramics Industry" by A. E. Stacy, Jr., Research Engineer, Carrier Engineering Corp., Newark, N. J.; and "Practical Aspects of the Casting of Heavy Pottery Products" by C. C. Treischel, R. T. Vanderbilt Co., New York City. Members of the party engaged in a golf tournament. An interesting business session preceded the addresses and the entire meeting was marked for enthusiasm.

WASHINGTON-BALTIMORE SECTION[1]

The third meeting of the Washington-Baltimore Section of the AMERICAN CERAMIC SOCIETY was held at the Garden Tea House, Washington, on June 7th at 7 P. M. The meeting opened with the usual informal dinner. Twenty-seven members were present. A. N. Finn, of the Bureau of Standards, was elected vice-chairman in place of Mr. Danielson, who has left the district. C. B. McComas, of the Carr-Lowrey Glass Co., was elected as a member of the Nominating Committee from this Section.

R. F. Geller, of the Bureau of Standards, made a talk on his recent trip to several refractory plants of Missouri and Colorado and described in an interesting manner the clay deposits and methods of manufacture.

P. K. Klaesuis, of the Porcelain Enamel & Manufacturing Co., gave a paper on ground coat practice, the second in a series of papers on enameling methods.

Edgar Worsham read a translation of a short German paper which contained suggestions on reducing costs in the enameling industry. While the attendance was smaller than usual, the meeting was enthusiastic and discussion of the papers was general.

NOTES AND NEWS

RESEARCH AT ILLINOIS

Six of the largest gas and electric concerns in Illinois are coöperating to spend $25,000 annually for two years in research at the University of Illinois.

The companies interested in this project are: Commonwealth Edison Company; the Peoples Gas Light and Coke Co., Public Service Company of Northern Illinois; Middle West Utilities Company; Chicago Rapid Transit Company; and the Chicago North Shore and Milwaukee Railroad Company.

The research to be conducted will relate to the following problems:

Electrical porcelain	$6500.00
Refractories	$6000.00
	$12500.00
Fatigue of structural parts	$7500.00
Boiler feed water treatment	$5000.00
	$12500.00

The investigation of research on refractories and porcelain will be conducted in the Department of Ceramic Engineering under the direction of Professor C. W. Parmelee.

W. L. Abbott, chief engineer of the Commonwealth Edison Co., and formerly president of the Board of Trustees of the University is temporary head of a Utilities Research Committee appointed to organize the work.

The agreement may be extended for an additional period later.

LIST OF STATE GEOLOGISTS[2]

We are frequently asked for the names and addresses of State Geologists. The following were obtained from Dr. W. A. Nelson, Sec. Association of State Geologists.

Alabama	Geol. Surv. of Ala., Dr. E. A. Smith, State Geologist, University, Ala.
Arizona	Ariz. Bureau of Mines, Mr. G. M. Butler, State Geologist, Tucson, Ariz.

[1] Recd. June 12, 1924.

[2] Corrected list, June 1, 1924.

Arkansas	Geol. Surv. Ark., Mr. J. C. Branner, State Geol., Fayetteville, Ark.
California	Cal. State Mining Bureau, Mr. F. McN. Hamilton, State Mineralogist, San Francisco, Calif.
Colorado	Colo. State Geological Survey, Dr. R. D. George, State Geologist, Boulder, Colo.
Connecticut	State Geological Survey and Dept. of Natural History, H. H. Robinson, Supt., New Haven, Conn.
Florida	Fla. State Geological Survey, Dr. Herman Gunter, State Geologist, Tallahassee, Fla.
Georgia	Geol. Surv. of Ga., Dr. S. W. McCallie, State Geol., Atlanta, Ga.
Illinois	State Geological Survey, Mr. M. M. Leighton, Chief, Urbana, Ill.
Indiana	Dept. of Geology and Natural Resources, Dr. W. N. Logan, State Geologist, Indianapolis, Ind.
Iowa	Iowa Geol. Surv. of, Dr. G. F. Kay, State Geol., Iowa City, Iowa.
Idaho	Dept. of Geol., Dr. F. B. Laney, State Geol., Moscow, Idaho.
Kansas	State Geol. Surv., Dr. Raymond C. Moore, State Geol., Lawrence, Kans.
Kentucky	Ky. Geol. Surv., Mr. W. R. Jillson, State Geol., Frankfort, Ky.
Louisiana	La. Soil and Geol. Surv., La. State University, Baton Rouge, La.
Maine	State Utilities Commission, Mr. F. F. Burr, Livermore, Me.
Maryland	State Geol. Surv., Dr. E. B. Matthews, State Geol., Baltimore, Md.
Michigan	Mich. Geol. and Biol. Surv., Mr. R. A. Smith, Director, Lansing, Mich.
Minnesota	State Geol., Dr. W. H. Emmones, Univ. of Minn., Minneapolis, Minn.
Mississippi	Geologic Economic and Topographic Survey of Miss., E. N. Lowe, Director, Jackson, Miss.
Missouri	Bureau of Geology and Mines, Mr. H. A. Buehler, Director, Rolla, Mo.
Montana	State Bureau of Mines, J. P. Rowe, State Geologist, Butte, Mont.
Nebraska	Nebr. Geol. Surv., Prof. E. H. Barbour, State Geologist, Lincoln, Nebr.
New Jersey	Dept. of Conservation and Development, Dr. H. B. Kummel, State Geologist, Trenton, N. J.
New York	Science Div. (Geological Survey), Dr. John M. Clarke, State Geologist, State Museum, Albany, N. Y.
North Carolina	N. C. Geol. and Econ. Surv., Chapel Hill, N. C. NOTE: This surv. was abolished by the last general assembly, effective Jan., 1925.
North Dakota	N. Dak. Geol. Surv., Prof. A. C. Lenord, State Geol., Grand Forks, N.D
New Mexico	R. W. Ellis, State Geologist, Albuquerque, New Mex.
Ohio	Geological Survey of Ohio, Prof. Jno. A. Bownocker, State Geologist, Columbus, Ohio.
Oklahoma	Survey abolished.
Oregon	Oregon Bureau of Mines and Geology, Mr. H. M. Parks, Director, 417 Oregon Bldg., Portland, Ore.
Pennsylvania	Topographical and Geological Survey Commission, Dr. Geo. H. Ashley, State Geologist, Harrisburg, Pa.
Rhode Island	Natural Resources Survey of R. I., Mr. Chas. W. Brown, Superintendent, Providence, R. I.
South Carolina	Prof. Stephen Taber, State Geologist, Columbia.
South Dakota	Geological Survey of S. Dak., Mr. Freeman Ward, State Geologist, Vermillion, S. Dak.
Tennessee	Tenn. Geol. Surv., Mr. Wilbur A. Nelson, State Geol., Nashville, Tenn
Texas	Bureau of Economic Geology, Dr. J. A. Udden, Director, Austin, Texas
Utah	Mr. Wm. Peterson, State Geologist, Agricultural College of Utah, Logan, Utah.

Vermont	Geological Survey of Vermont, Dr. Geo. H. Perkins, State Geologist, Burlington, Vermont.
Virginia	State Geological Survey of Virginia, Dr. Thomas L. Watson, Director, Charlottesville, Va.
Washington	State Geological Survey of the State of Washington, Mr. S. Shedd, State Geologist, College Station, Pullman, Wash.
West Virginia	W. Va. Geological and Economic Survey, Dr. I. C. White, State Geologist, Morgantown, West Va.
Wisconsin	Wisconsin Geological Survey, Mr. W. O. Hotchkiss, State Geologist, Madison, Wis.
Wyoming	Mr. G. B. Morgan, State Geologist, Cheyenne, Wyoming.

UNIVERSITY GRADUATE FELLOWSHIPS

Graduate fellowships in mining, metallurgical and chemical research are offered by various institutions of learning, in coöperation with the Bureau of Mines, Department of the Interior. The purpose of these fellowships is to undertake the solution of various problems being studied by the Bureau of Mines that are of especial importance to the regions in which the institutions of learning are located. They afford excellent opportunities for qualified young men to become experts in the fields of mining, metallurgy and chemical technology, and to prepare themselves for highly technical work in these fields.

For the college year 1924-1925, the following institutions offer such fellowships:

University of Alabama, Tuscaloosa, Ala.
University of Arizona, Tucson, Ariz.
Carnegie Institute of Technology, Pittsburgh, Pa.
University of Missouri, Rolla, Mo.
Ohio State University, Columbus, Ohio
University of Utah, Salt Lake City, Utah
University of Washington, Seattle, Wash.
University of Idaho, Moscow, Idaho.

The value of the fellowships offered by the University of Alabama is $540.00 per annum. At this institution five fellows were appointed for the college year 1923-24, whose investigative work related to the washing of Alabama coals and the beneficiation of low-grade brown, red hematite and gray specular hematite iron ores.

The University of Arizona offers fellowships of a value of $750.00 per annum. Previous work performed by fellows at this university has related to the selective flotation of copper sulphide minerals and the leaching of heavy sulphide cupriferous ores with ferric salts.

The value of the Carnegie Institute of Technology scholarships is $750.00 per annum. In 1923-24, six fellows at this institution studied the use of gas masks in fighting mine fires; efficiency in blasting coal; friction losses in mine cars; corrosion of metals and alloys in acid mine waters; time-rate of combustion of coal dust particles; and the correlation of coal beds of western Pennsylvania and eastern Ohio. For the coming year there will be either six or seven fellowships in coal mining, four of them supported by Carnegie Institute of Technology and two or three by the industry. One to be supported by the Hillman Coal & Coke Company is definitely agreed upon. A second fellowship on friction losses and mine car axles and bearings is to be supported by the manufacturers. A third, on the efficiency of blasting coal, will probably be supported by one of the coal companies.

The value of the fellowships of the School of Mines and Metallurgy of the University of Missouri is $800.00 per annum. In 1923-24 two fellows studied the influence of time, temperature and rate of cooling on mine drill steel, and the effect of various factors on the rate of reduction of zinc compounds by carbon.

The Ohio State University fellowships are valued at $750.00. Fellows at this institution have studied such problems as the use of dolomite for refractories and the electrical conductivity of refractories at high temperatures.

The University of Utah fellowships are valued at $720.00 per annum. In 1923-24 five fellows studied the utilization of Utah hydrocarbons; the hydrometallurgy of zinc; ore dressing problems; and the geology and microscopic examination of complex zinc ores.

The value of the University of Washington fellowship is $810.00 per annum. In 1923-24 five fellows at this institution studied the washing of Washington coals; the preparation of super-refractory products and electrometallurgical problems.

The University of Idaho fellowships are valued at $750.00. In 1923-24 the fellows at this institution studied the treatment of various gold-silver ores.

Detailed information in regard to these fellowships may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C., or from the various institutions named.

BUREAU OF MINES NOTES

Georgia Clays for Rubber Fillers

A study of Georgia white clays with respect to their use as fillers in rubber has been completed by the Department of the Interior technologists on the staff of the Bureau of Mines. The purpose of this work, which was performed in coöperation with the Central of Georgia Railway, was to determine which Georgia clays, when properly prepared, are suitable for use in rubber compounding. Samples were collected from various deposits not now used in preparing rubber filler, as well as clay from those mines which are already producing clay for use in fillers. The samples were washed, dried, pulverized and purified in accordance with good commercial practices, and their chemical and physical properties carefully determined. Tests were then made in commercial plants on selected samples. It was found that some of the clays were suitable for use in making high grade rubber. There was, of course, a considerable range in the properties of the different clays tested. It was shown that fineness of grain is one of the most important physical factors in the reinforcing power of the clay. Further work along this line is desirable.

Mineral Grinding Studies

The grinding of flint for ceramic uses is a quite difficult problem on account of its great toughness and resistance to abrasion. Heating the material before grinding makes the process easier. Interior Department investigators at the New Brunswick, N. J. experiment station of the Bureau of Mines will make experiments to test the efficacy of combined heating and quenching. The method may be extended to other minerals.

Sillimanite

Only small, scattered deposits of sillimanite are known in the United States, no commercial sized deposits being located to date, according to W. M. Myers, assistant technologist, Department of the Interior, in Serial 2587 of the Bureau of Mines. A large deposit is reported to occur in India. Very superior refractories are said to be made almost exclusively of synthetic sillimanite. Whether natural cyanite or sillimanite can be substituted can only be determined by careful research. As the value of the andalusite group of minerals becomes better known and as more people become acquainted with their appearance so that they can

recognize them in the field, it is possible that other deposits may be found possessing sufficient tonnage and favorably located with regard to transportation to make their development possible.

Oxidation of Ceramic Wares during Firing

In connection with an investigation of the oxidation of ceramic wares during firing, being conducted by the Department of the Interior at the Columbus, Ohio, experiment station of the Bureau of Mines, a study of the effect of varying the rate of gas flow and of heating on the decomposition of pyrite in clay has been made. This work will be extended to include a number of typical fine grained commercial clays. It is felt that this work may have a very practical bearing on the method of firing ceramic kilns.

Expansion of Flint Fire Clay during Heat Treatment

The purpose of an investigation being made by the Department of the Interior technologists at the Columbus, Ohio experiment station of the Bureau of Mines is to ascertain as definitely as possible what causes flint fire clay to change its volume during the process of heat treatment. Results to date indicate that the Missouri flint clays have a much greater shrinkage than the Pennsylvania flint clays. A comparison of the burley flint and smooth flint clays taken from the same locations shows that the smooth flint clays shrink to a greater degree. The difference in shrinkage is attributed to the diaspore present in the burley clays, which acts like a grog.

Lime from Small Stone

Profitable disposal of limestone too small for making lime in the shaft kiln is one of the most urgent problems in the lime industry, states W. M. Myers, assistant mineral technologist, Department of the Interior, in Serial 2596, recently issued by the Bureau of Mines. Reports received by the Bureau of Mines from 31 quarries show that the proportion of small stone varies from 2 to 40 per cent, averaging 18 per cent of gross production. Modern methods of heavy blasting, and the use of crushers in large quarries tend to increase the proportion of small stone above that produced in early days when light blasting and hand sledging were almost universally used. There is also a growing movement toward underground operation of lime deposits, a method which in general produces a greater proportion of fines than is encountered in open-pit work. Thus the small stone problem is of growing importance, and demands the attention of every progressive lime producer. The general problem of the production of lime from small stone is considered by Mr. Myers in Serial 2596, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

BUREAU OF STANDARDS

Light Waves Used to Measure Thermal Expansion

The rate at which porcelain and other ceramic materials expand with increase in temperature is measured at the Bureau of Standards by means of light waves, using a method recently developed there. Small pins of the material from 0.02 to 0.4 inch long are placed between two interferometer plates of fused quartz and are heated in an electric furnace. Interference fringes are formed by the light reflected from the interferometer plates, and pass the reference marks on the plates as the sample expands with heating. A change of length of a millionth of an inch can be detected by this method, the Bureau states.

Interference fringes are formed where light reflected from one surface joins light reflected from another. If the two waves when they reach the eye are opposite in

phase they neutralize each other and produce darkness. If they are the same in phase they reinforce. The number of fringes formed is therefore proportional to the number of wave lengths of light in the distance between the plates. Light waves vary in length from red waves, 0.000028 inch long, to violet waves of little more than half that length. Light of one color is used in the tests.

Using this method the Bureau has made measurements of the thermal expansion of several samples of glaze, terra cotta, tile, porcelain, and clay between the temperatures of 20° and 2000°C. Some of the samples were specially prepared while others were taken from finished products, and some of the latter were from products that had failed in service.

The results of measurements showed that the thermal expansivities of ceramic materials may differ greatly. When two or more are combined, therefore, failure of the ware may be caused by this difference. Glaze applied to tile, for example, may crack or scale off for this reason.

It was also found that such materials might undergo permanent dimensional changes when subjected to heat treatment and that their expansivities might be very different at different parts of the temperature scale. Cracking may occur if such a material is heated or cooled quickly, or strains may be set up that may cause subsequent failure.

This method and the expansivity measurements made with it are described in Scientific Paper No. 485, of the Bureau of Standards entitled "Application of the Interferometer to Measurements of the Thermal Dilation of Ceramic Materials" by G. E. Merritt. Copies may be obtained from the Supt. of Documents, Government Printing Office, Washington, D. C. The price is 5 cents.

1924 CLAY PRODUCTS CYCLOPEDIA NOW AVAILABLE

The first paragraph of the preface to the new 1924 Clay Products Cyclopedia, now published, indicates the desire of the editors that the improvements in the book shall go a long way to making it useful and valuable to the industry. This paragraph reads as follows:

"In publishing this second edition of the Clay Products Cyclopedia, we have spared neither expense nor effort to improve the book in every way possible so that it can more fully fill its mission as the standard reference hand-book for all executives of plants."

Information of Value to Everyone

A large part of the book is entirely new, and some of it has never been published previously. This new material will interest every executive in the plant. For instance, on page 76 there is a table headed, "Handy Calculations for Discounts." This is good for the Purchasing Agent, the Accountant, and those who check bills. When an invoice comes in showing a discount of 45, 10 and 5 per cent off list, ordinarily three multiplications and subtractions would be necessary. With this table it is only necessary to make one operation by deducting 54 per cent.

Everyone at times wants to know the equivalent temperatures of the Centigrade and Fahrenheit scales. It is always necessary to remember the formula, dividing by 5, multiplying by 9 and adding 32. With the table shown on page 208 of this book, all of this work is unnecessary. The exact reading of any temperature can be found in a moment and there is no chance or opportunity for error.

Glaze Formulas

Many glaze formulas and similar data have been added on pages 116, 117 and 118. Moreover, on page 7 a very complete and accurate method is explained for changing a chemical formula for a glaze into its equivalent in batch weights of commercial materials. This is especially valuable to one not possessing a technical education.

Section on Fuel Oil

The large amount of interest that is being evidenced at the present time in fuel oil is satisfied by more than three pages, 110, 111 and 112, almost all of which is entirely new. Some of it has been included only by special permission. Part of this item gives comparative properties of the various oils from the different fields of the country.

The question of storage tanks for oil is also a big item today and part of this space is devoted to this feature. Other items covered are the changes in volume of oil due to temperature—heating values of fuel oil, pounds per gallon, and so forth, for the various degrees of the Baumé hydrometer and similar data.

Likewise additional data have been inserted on the question of coal on pages 49 to 55. The report of the Bureau of Mines showing comparative properties of practically every coal field in the country is included so that manufacturers can determine the best coal for their individual use.

Catalog Section an Improvement

These are only a few of the new items in the reference or editorial section that will appeal to the various executives in a plant.

The catalog section is a very big forward step. This section contains 70 pages of condensed catalog information, giving sizes, capacities, dimensions, prices, buying specifications, requirements for certain conditions, photographs of both equipment and installation, and other details.

The Clay Products Cyclopedia is published by Industrial Publications, Inc., 407 South Dearborn Street, Chicago, and is priced at $3 per copy. The publishers will be glad to furnish any additional information desired.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21—Aug.—1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
American Foundrymen's Association	Oct., 1924	
American Gas Association, Inc.	Oct., 1924	
British Assn. for the Advancement of Science	August 6–13, 1924	Toronto, Canada
Chemical Equipment Assn.	Sept., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Paving Brick Assn.	Dec., 1924	
Society for Promotion of Engineering Education	July, 1924	Boulder, Colo.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)

Personnel of Local Sections

	Baltimore-Washington	California	Chicago	Detroit	Eastern (New Jersey)	New England	Northern Ohio	Pacific Northwest	Pittsburgh	St. Louis
Chairman	B. T. Sweely	A. Malinovsky	H. C. Beasley	A. B. Peck	Charles W. Crane	A. E. Baggs	A. S. Zopfi	F. T. Houlahan	J. W. Cruikshank	F. E. Bausch
Vice-chairman	A. N. Finn	G. Ray Boggs	William Knowles		Leslie Brown		E. P. Poste	J. H. Corbett		
Secretary	Herbert Insley	T. S. Curtis	R. C. Rahn	H. F. Royal	George H. Brown	C. H. Lawson	Geo. H. Hays	Hewitt Wilson	H. G. Schurecht	L. C. Hewitt
Treasurer	Herbert Insley	T. S. Curtis	R. C. Rahn	H. F. Royal	George H. Brown	C. H. Lawson	Geo. H. Hays	Samuel Geijsbeek	T. H. Sant	L. C. Hewitt
Councillors	Karl Turk	F. B. Ortman	C. W. Parmelee	F. H. Riddle	C. A. Bloomfield	A. A. Klein	R. D. Landrum	Samuel Geijsbeek	F. W. Walker	A. F. Daves
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Program	R. F. Geller: *Chairman* K. Turk S. Leech A. W. Crownover E. O. King P. H. Bates E. W. Washburn	H. E. Davis *Chairman* H. T. Coss C. W. Jackson P. Larkin H. A. Huisken H. Condon B. M. Burchfiel	G. Blumenthal, Jr.	M. D. Lucas W. A. Carter H. M. Kraner	D. P. Forst F. A. Whitaker Leslie Brown		L. D. Mercer G. T. Stowe P. Dressler		J. S. McDowell F. C. Flint *Entertainment* H. G. Willetts	C. W. Berry: *Chairman* C. H. Modes F. G. Saeger
Executive		*Constitution and By-Laws* T. S. Curtis W. G. Brady			Officers and 20 others	M. F. Cunningham	A. S. Walden W. M. Clark	P. S. Mac Michael A. B. Fosseen H. Hoffman		F. E. Bausch L. C. Hewitt A. F. Daves G. E. Thomas C. W. Berry
Nominations	C. B. McComas	H. A. Huisken			C. F. Geiger	A. A. Klein M. F. Beecher			A. W Kimes R. F. Ferguson J. W. Cruikshank	J. L. Crawford

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Vol. 3 | August, 1924 | No. 8

EDITORIAL

COLLABORATION IN RESEARCH

Not long ago college men in ceramics were called "high brow," "not practical." This adverse attitude toward them was the rule. Those college men who were succeeding in industrial positions were believed to have had exceptional ability or advantages. Technical research would not be tolerated. Years of experience was considered to be the only sesame to ceramic wisdom. "Trade secrets" and the "Formula Book" were jealously guarded. Manufacturers would not collaborate together.

How different it is today. Men trained to use the fundamental science data and methods are largely employed. They are considered essential even by the craftsmen. Formulae are not guarded so jealously. Manufacturers are collaborating more freely in things technical. Collective support of researches is now the rule. Ceramic manufacturers of the same sort of ware have for a few years past been supporting technical researches through their respective trade associations and now the different trade associations are to engage in joint support of technical investigations. They realize that only thus can they most quickly and most assuredly obtain lower manufacturing costs and establish the utilitarian superiority of their product.

A Ceramic Institute is almost beyond the "possibility" stage. The report of an organizing meeting in which eight associations participated

is given on page 317 of this *Bulletin*. The trade press has frequently printed notices of the developments in the idea of collective researches by trade associations. The Ceramic Institute is well nigh a reality.

Members of the AMERICAN CERAMIC SOCIETY must be acquainted with and assist their SOCIETY in keeping in line with this forward moving enterprise. Collective support of technical investigations has been the SOCIETY'S chief aim. It cannot do else than to give this new movement every encouragement and assistance.

There is another enterprise by our ceramic trade associations which should be encouraged. In editorials and in news reports the SOCIETY has hailed with delight the idea of regional Foremen Institutes. The Refractories Manufacturers Association has for a year or more conducted quarterly meetings of Foremen Institute with resulting inspiration and information to the men who are leaders in their members' plants. Such meetings of foremen from neighboring plants manufacturing like goods by practically the same methods and equipment will surely result in lower cost of production and better quality of ware. A larger appreciation of the user's problems and a keener desire to solve them with their product is given to the factory bosses. A closer bond of mutual responsibility and a more responsive desire to assist is obtained between the salesmen and the factory foremen. These Foremen Institutes are most excellent enterprises.

There is another coöperative activity under consideration with full expectancy of early adoption. Some of the trade associations are planning for mid-year and annual meetings of the technologists from their member companies' plants to be held at the same time and place of meeting of the trade managers. This is another evidence of a rapidly growing appreciation of the money value of collaboration in technical investigations.

The AMERICAN CERAMIC SOCIETY cannot fail to give to these new coöperative research enterprises that same encouragement and assistance which it has given to establishment of ceramic laboratories in the federal and state institutions. There need be no worrying about overlapping of activities. Such overlapping as there will be for a while will soon disappear. That combination of joint enterprises which is best for the ceramic industries collectively will be continued. The SOCIETY has promoted these enterprises; it will align itself with them in the manner most helpful.

PAPERS AND DISCUSSIONS

ART IN INDUSTRY[1]

BY RICHARD F. BACH

This is not an article on the business of art; nor is it concerned with the art of business. It has the simple thesis that art is worth money in trade, that art annually sells products valued in billions of dollars, that artistic design is a selling point as important in several scores of art industries as warmth is in selling wool, endurance in selling tires, health in selling cattle; in other words, that many industries count on art as an initial ingredient without which their products would not be salable.

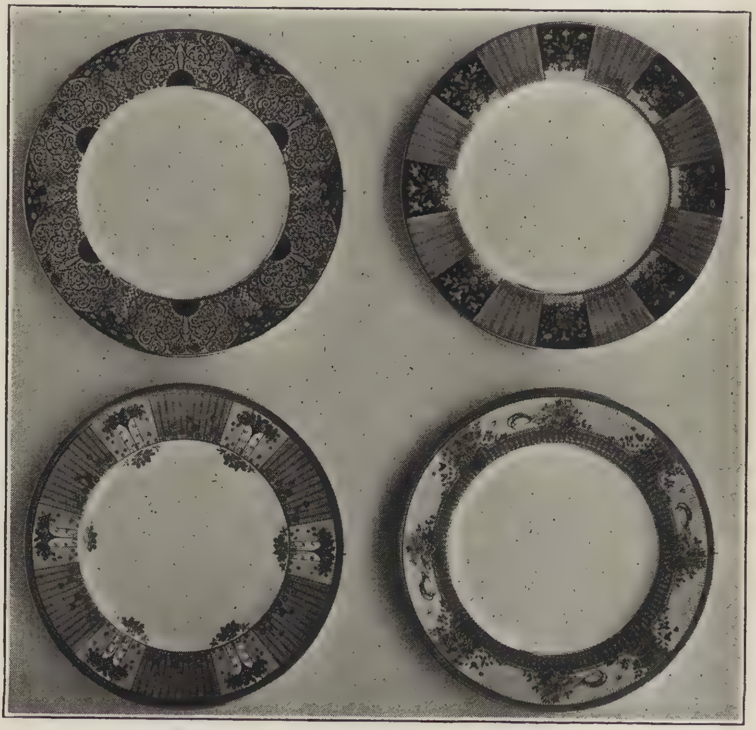
The conception is not new; it is as old as architecture, or better, as old as personal adornment. Man has always counted heavily on appearances and, if Bryan will permit, ages of animal life from which man grew did the same before him. To count on appearances does not mean to favor externals regardless of structure beneath. Good appearance, attractive design, is not superficial in value or intent, even though actually applied on the surface. It is part of the first conception of the object.

The design of a locomotive or trip hammer or steam shovel implies its mechanical function. By comparison, the design of a chair or a lamp also implies a utilitarian purpose; and the design of a cuff link or an ink-stand or a collar box maintains the same principle. Compare Peter Cooper's first "steam wagon" on the B. & O. with the iron horse that hauls the Twentieth Century from New York to Chicago. The difference is seen first in design as expressive of function, second in the effort to make the newer thing more attractive, "better looking," more appealing to the eye, which is a roundabout way of saying more satisfying to the mind. Practical hand-satisfying function has begun what more ethereal mind-satisfying design must complete. Design cannot make amends for lack of functional value. A beautifully designed stove that is not constructed for draft is neither a good stove nor a good design, because in the first place it must be useful.

Typewriters of long ago were highly decorated—with paint, but they were of limited practical value. Typewriters of today are the acme of practical value and their decoration is one of form alone. Yet compare the first Remington with the latest portable model; the advance in function has been backed up at every step by an effort to develop a better looking machine. Design has worked out from the facts, which require the maximum strength and service from the minimum of material; design subscribes to this principle of our vaunted efficiency. No doubt a great part of this effort is unconscious; that is its saving grace and greatest advantage, that is its fundamentally human quality.

[1] Prints for this paper were furnished through courtesy of the Metropolitan Museum of Art.

Our examples above are drawn from fields in which mechanical design predominates. But design as expressive of function is just as characteristic of products in which mechanism does not count, but in which the physical function has to a great extent yielded importance to the mental. A device for mechanically squeezing oranges may be very useful without being attractive; yet as soon as it has reached a standard of performance it is made more attractive in appearance, so that it becomes an asset to the soda fountain. By contrast, a well-built safety clip and the strongest



Plates designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

silk string or alloy joints or patent settings are but minor considerations in a necklace. The factor of utility in the practical sense is small as compared with the mental satisfaction found in the appearance of the piece. Beauty comes into play, and in the daily grind we may call this "artistic design" as distinguished from the more directly practical design of the machine. In an ideal world, some day, there will be beauty in both, for the beauty of use and the use of beauty respond to related areas of the mind.

Artistic Designs Sell the Product

It is with the so-called "art industries" that we are here concerned, industries in which artistic design sells the product. Consider women's handbags or bathing suits, men's shirtings or cravats, ribbons, lace, flappers' scarfs, or sport clothes for both sexes, to mention but a few items in the ever-changing kaleidoscope of fashion; in these we have the most exaggerated examples of the selling value of artistic design, the commercial value of the "better looking" thing, the cash value of beauty. It is an admissible argument that in such products, created for ephemeral

China designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

use, the sale is quick and the beauty therefore of the same stamp; true, but the process of thought which accomplishes the purchase is the same.

Material, Execution and Design

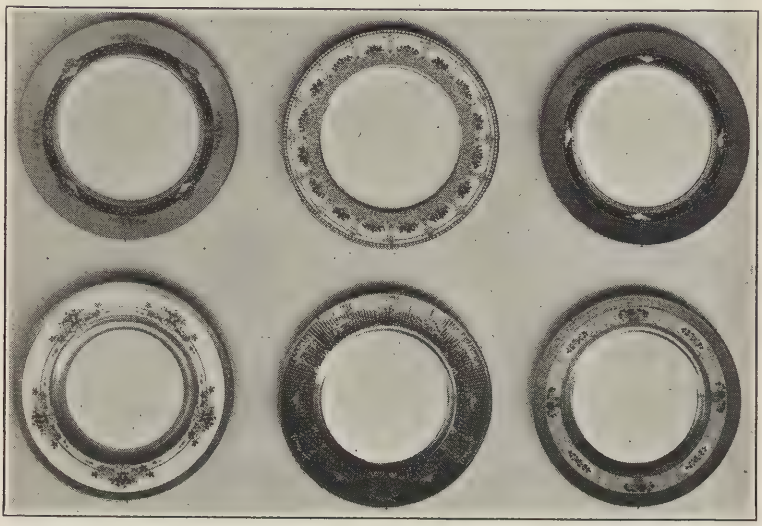
Refer the matter then to more solid things, such as rugs, armchairs, sideboards, wall paper, lighting fixtures, linoleum, upholstery fabrics and other elements in home furnishing. Here we seem to restore the balance. Material, execution and design, the controlling triad of manufacture, are seen in proper proportion.

Material, execution and design are the leading considerations that guide the product from first conception to finished piece on the salesroom floor.

Materials we know and can choose. Execution we know and can master; we have equipment and the power to control it. But what of design? In American art industries today design is the stepchild.

Design Subscribes to Mechanical Limitations

Business men have reasoned it out for themselves over and over again. The hand is too slow to supply the mass with, let us say, woven silks. Mechanical means are soon found for weaving the silk. The new toy is developed to an egregious degree; attachment follows attachment, until the apparatus is so complicated and seemingly so omnipotent as to stagger its inventors. Millions of yards are fed to its rollers and shuttles with amazing results. No one seems to notice that the



Plates designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

mechanism has become the master, that every design produced subscribed more and more to mechanical limitations, progressively lost vitality and artistic expression (which I hold to be the equivalent of salability); that in the end there would be a stalemate. Thousands of yards from a single motive, drawn up in a space perhaps eighteen inches square; thousands of yards of assured sales before the loom can with profit be set in motion.

This is spreading design on very thin, thought some; when one design can travel as far as that, it cannot be very important in a single yard. No, said others, the more yards you weave the more important is your design for a single repeat; the business value of the original design must be multiplied by the number of times it is used. These two opinions still

continue side by side. Those who favor the latter are still in the minority and will be until American business sees its daily loss.

Business has given much thought to raw materials, their selection, naming, storage, and preparation for use; business has also collectively studied production, processes have been standardized, the cost of a single movement of a single operative is known, machines and management hold no secrets; turnover, transportation and other details are an open book. And there business has stopped. It has gone but two-thirds of the way.

Design as a Controlling Factor in Production

Business has never collectively interested itself in design as a controlling factor in production. It has been blinded by volume, dazzled by numbers; it has made ten thousand rolls of wall paper as intelligently as it has made ten thousand kegs of shingle nails. The process has been perfect—mechanically; perfect in the same sense that the phonograph is a perfect representation of the voice. The difference is that these rolls of wall paper can in the end achieve a form of appeal which kegs of nails must forever lack, if they are to continue useful.

Coffee Server designed by Frank G. Holmes from porcelains in The Metropolitan Museum of Art; executed by Lenox, Inc., 7th Manufacturers & Designers Exhibition, 1923.

In producing this wall paper, and we could as well say carpets, candlesticks, book-bindings or ceramics, business has aimed at perfection in material and perfection of handling. Design has just "sort of come along;" worse than that, it has been neglected, forgotten, marooned and often made to walk the plank. At the same time, when a sale is made, what is the talking point that carries the greatest weight? This same design which seems insignificant at the beginning of the process of production suddenly assumes importance.

Design a Controlling Factor in Sales

The manufacturer says to the buyer from Field & Creery's: I want you to note this timber, get the weight and strength of it, the way we have treated it with this and that; then look at our construction, the finest piece of joinery to be seen in the markets of the world; then this finish, etc., etc. Meanwhile, the buyer's picture of prospective sales has granted meager space to wood and build and varnish; it has been based mainly on comfort

and convenience in use and on appearance, which is design. He has seen comparative values on the fourth floor of his store, the values that control his customers' judgment, for he knows that while a cross section of an ice box may be good evidence, the same is not true of a dressing table.

The best wood and the best construction may still make a garish rocker that the market will absorb, flamboyant carving, green plush covering and all. If that is the bull's eye for which business aims, there may be need for prayer, but there is no need for fervent paragraphs like these. The finest wood and superlative construction are powerless, even useless, certainly without character, unless they find expression in the best design. Fine design will sell poor materials and mediocre workmanship, but the opposite is false.

Coffee and Tea Set. Plates designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art.

A chemical formula may be re-vamped year after year and sold under the name of perfume, if the design of the bottle keeps step and the design of the advertising backs it up: an evil example, chosen from the borderland of legitimate business, but a proof. What flimsy materials have you seen used for women's clothes, wondered at their wearing qualities and stared at their price? The design of the garment has sold them. You may take several yards of straw, some silk, wire, thread, ribbon and a few flowers, and out of this concoct a marvel of millinery. The materials may cost you five dollars; the hat will sell for fifty. Yes, there is the cost of making, labor, rent and other overhead; there is the cost of merchandising, wages, packing, and again the overhead. These may make the difference in actual figures, even though we allow a profit of only twenty-five per cent. But have any of these sold the hat? Design alone did that.

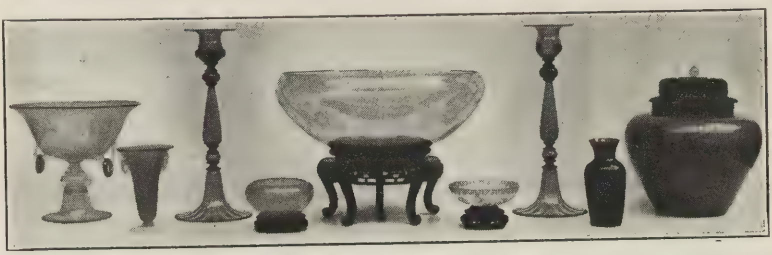
America Needs Schools of Industrial Art

A similar defense may be written for design in several scores of art industries. Costume alone, not counting uniforms or men's clothing, represents an annual outlay of American money totaling $500,000,000. Home furnishings cost a similar amount. Add to that the other types

of industrial art, printing, jewelry, building, etc., and we reach a sum which, in the language of the columnist, would buy New York. This is the consumer's outlay. The products so purchased are not always the output of American labor and skill. In this is our greatest failing.

We have for decades exported raw materials to Europe and bought back finished products from Europe. We have paid the transportation both ways. We have made our own materials climb the tariff wall to get back to us. We have paid all the intermediate profits. So these

Glass in various colors, plates in mirafiori designed by Frederick Carder, executed by Corning Glass Works, Steuben Division, American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.



Decorative glass designed by Frederick Carder, executed by Corning Glass Works, Steuben Division, American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

millions that are commanded by design in manufacture and sale in great part go to Europe.

Suppose you export cotton to England and buy it back as knit goods. Before the knit cotton goods gets back to us the English have added 80% to its value. They have added skill in manufacture. Americans pay this 80% and in addition Americans pay the freight, the tax, the merchandizing cost and the several profits to our own middlemen.

In printed cotton goods skill adds 125%; in pottery 290%; in clothing 500%. Skill is nothing but manipulation of material to produce the design

which commands the price in the end. We cannot say what design alone is worth. It is part of material; it is part of execution; it is a factor, not a figure by itself.

The curious thing, the un-American and inefficient thing, about the whole matter is that design has not received attention from business men. Have they founded or aided schools of industrial art? Do they coöperate with schools by linking theory with practice? Yes, one out of a thousand has done this. Business will establish a class to teach the care of cutting edges of tools and give never a thought to training the artist-artisan whose

Tiles in antique design by Rafael Guastavino. 4th Manufacturers' and Designers' Exhibition.

hand controls these cutting edges. His skill has been figured as less important than the tool he uses. I have in mind the organization chart of a knitting mill in which there are four process instructors, and only one designer.

And again, do American manufacturers favor foreign designs? Yes, many do and will persist in buying designs abroad. Do these same men in a definite, practical way aid American designers or advise their instructors? Yet their criticism of existing schools is both plentiful and caustic.

Finally, do American distributers buy American goods and sell them under a foreign label? Or do only foreign concerns with establishments in American cities grovel in this way for the dollar? These are sore spots. Time alone will not heal them. Remedy lies in constructive effort. Without this we will come more and more under the heel of Europe in many art industries.

When the war began our designing rooms were manned by foreign talent. With the first gun these designers left us as though in a single shipload. We had no substitutes. Blissful ignorance had built no bulwark against such an emergency. Business talked and prayed and hoped, mostly hoped. Not a single school was established. If any came into being, surely they are not with us now. As soon as the war ended, the orgy of exportation of

Stories by Rafael Guastavino, working in the manner of Persian luster painting.

raw materials began again and at the same time products of foreign skill crowded out American products in the stores. America has nothing to show for it—the best opportunity that ever came to a country to study its own needs. Self-examination is not our leading national trait. But there has been some progress; there are a few long heads among us, a few giants with vision, who have hewn to the line and often lost by the effort.

Sales Force and Customer Should Appreciate Design

Glib complaint is easy. We have censured producers, but we have not meant to spare distributers. Of the two, we hold the store to be the greater sinner. Stores have devoted increasing attention to selling service,

but have not taught their clerks the meaning of design. The customer knows what she likes, the clerk knows what is on the shelf; they can get together only in the matter of design; this is the common ground. So the store must extend its service in that direction. For the store stands between manufacturer and consumer, arbiter of taste for the millions, and by the same token dictator of the factory's efforts.

The consumer can hardly be blamed. How shall he find out about design? The schools do not help him gain appreciation; a handful of schools have begun to teach how to buy, which means how to discriminate between designs.

In this as in many large questions there is a vicious circle, of which the beginning is also the end. So in the present case the circle must somewhere be cut so that a beginning may be made in the direction of improving design. While for the consumer good design may mean satisfaction and

Bowls of Persian type, luster studies by Rafael Guastavino, 4th Manufacturers' and Designers' Exhibition, 1919.

peace of mind, for the merchant it will mean increased service, good will and profit; for the manufacturer a better product, a steady market, a larger working margin; and for all three a better bargain.

But the mass of consumers is too great to be quickly taught; educational systems must grow up to its needs. This they are doing, though with painful slowness. Meanwhile, our circle can be cut in two places. The producer and the dealer represent smaller workable numbers. These can, by taking advantage of existing facilities, largely educate themselves toward a higher standard in design. They can go to school with past masters of their crafts or business pursuits, for at all times art has commanded a price, design has been sold and the making of it has been a source of income.

Museums as Schools of Industrial Art

They can find resource at the museum of art. Whatever the problem, leather purse or celluloid hair ornament, candy box or umbrella handle,

coat lining, bone button, piano, kettle drum, handkerchief, talcum box, advertisement, porch chair, teapot or doorknob, no matter what type of object as to purpose, material or form, if it falls in the field of useful objects made attractive by design the museum of art can help. The accompanying illustrations show how one museum has helped in a practical way. These producers have obtained authentic information at the fountain source of design; they have figured it out that the value of their products is threefold: material, execution and design. Above all, they have come to regard a museum of art as a silent partner in business, while their designers have added its collections and facilities to their laboratory material.

Not to be outdone, certain dealers have shown a similar advance. They now attend in scores several series of conferences at which are dis-

Studies in slip and luster applied upon ordinary vessels, by Rafael Guastavino shown in 4th Manufactures' and Designers' Exhibition, 1919.

cussed the fundamentals of form and color as related to practical purposes and as expressing current selling values. And all of this on the basis of originals tested by time and preserved because of this same transcending quality of design.

Industrial Support of Art

These are but two indications of how one great public art institution works. They would not be possible if there were not fertile ground to till. And they are in themselves inconceivable without the backing of the trades. Yet they indicate plainly the Metropolitan Museum's conviction that art has a commercial value, an idea which, ludicrous as it may seem,

must yet be sold to the vast majority of producers and dealers in the art industries.

It comes to this: the art trades must stand and deliver. The American public is rapidly approaching the place where it will say: we want the best design by an American designer in all our home furnishings, in our clothes and our books; we want American-made products, no matter whence the raw material comes; we are not dazzled by the European trademark, it is no guarantee of either quality or design; we don't like *Nippon* on our teacups, *Paris* on our gowns, *Germany* on our toys; we are glad to see *Made in the U. S. A.* on these and a thousand other objects; and, finally, we are willing and able to pay for good design wherever it may be considered rightfully as adding to the cost.

Business must keep ahead of the game. The art trades must lead. The better thing must be ready before the consumer demands it. Provide excellent design and these millions will stay in America. Provide excellent design and American industry will grow.

METROPOLITAN MUSEUM OF ART
NEW YORK CITY

BALL CLAY SPECIFICATIONS[1]

BY ARTHUR S. WATTS

Ball clays are sold directly from the mine without processing, other than the air drying which may occur under favorable circumstances. The development of specifications covering the purchase of such material is rendered more difficult by the fact that the material is shipped in lumps which make the taking of a satisfactory sample exceedingly difficult.

Disagreement as to what exact properties possessed by ball clays form the basis of its commercial value increases the difficulty of developing a set of specifications satisfactory to both producer and consumer.

The following must, therefore, be looked upon as only a preliminary step in the hope that an interest may be awakened in the subject, and by constructive criticism and discussion a satisfactory conclusion reached.

The *ball clay deposit* is sedimentary and consists of numerous strata which frequently vary greatly in physical properties although perhaps not greatly in chemical composition. The different strata may or may not vary greatly in color and may be sharply defined or may merge into one another so that the lines of division may be very difficult to determine. As a rule, however, the portion of a ball clay deposit marketed under an individual name or number has a rather definite boundary although it may contain streaks or lenses of material widely different in color or other properties from the mass of the deposit. The presence of this foreign clay material as well as the presence of woody tissues further complicate the

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Whitewares Division).

sampling process. When sandy streaks or lenses occur in a deposit, the problem of sampling is made abnormally difficult since this portion air dries much more quickly than the more plastic portions and tends to sift to the bottom of a shipment and is frequently lost sight of in ordinary sampling.

The Free Water in Ball Clay

The drying of ball clay is difficult owing to the density of the masses and unless properly conducted may even be dangerous. Some users prefer ball clay which has never dried out, claiming that it loses some of its essential properties if completely dried even though no artificial heat is employed. If properly dried, this claim is of doubtful importance when compared with the benefits derived from the use of dry clay. Few buyers of ball clay realize either the extravagance or the dangers that attend the use of wet ball clay, except under the most careful plant control.

For example, take a domestic ball clay costing $5.00 per ton f. o. b. cars at mine and carrying freight charges of $5.00 per ton. If the clay contains 20% of water, the buyer pays $10.00 for 1600 lbs. of clay or $12.50 per ton of clay. The shipper receives $1.25 for loading the water and the railroads $1.25 for hauling the same water. The receiver has also the expense of handling the water on its arrival. It would be far cheaper for the consumer to pay the shipper the difference, provided it was a means of obtaining a properly dried product.

The drying of materials at moderate or even atmospheric temperature is much better understood than was the case even a few years ago and if moderate care is exercised in mining and handling, it appears practical to have all ball clay delivered with a maximum of 5 or 6% water.

A frequent cause of variation in behavior of ceramic bodies is the water in the ball clay. We hear of many plants which claim to operate on a dry basis for all raw materials but in even the most exacting of these, a shipment of wet ball clay will be drawn on for a day or more before the scales are corrected, or a supply of wet ball clay exhausted and a dry supply drawn on which may cause even more serious results though not the same. The establishment of dry ball clay as a standard material is obviously worth while but cannot be hoped for without some concessions from both buyer and shipper.

Since, however, we find that a large portion of the ball clay delivered to our industries is distinctly wet, we must take this into consideration in developing methods of sampling, and testing for purchase and control.

Chemical Composition

While a properly made chemical analysis may furnish valuable data on a ball clay, especially as a guide in determining the uniformity of the products of a single deposit mined over a long period of time, there is doubt whether it is a safe basis for substitution even among clays from

different strata of the same deposit. Much, however, may be inferred as regards probable physical and pyrometric properties from an intelligent study of the chemical analysis and its value is not to be questioned. It is seldom practical to make a chemical analysis of a thoroughly representative sample from each car-load shipment, so that its service is limited.

Sampling Take six samples, one two feet from each corner of the car and one from the center on each side of the doorway. See that each sample represents all colors encountered and if sandy material covers the floor, see that this is also represented. In taking samples from lumps, cut or chop a slice $^1/_2$-inch thick from each lump in the zone sampled and in proportion to the size of the lump. Each sample should exceed five pounds in weight. As soon as collected, the samples should be reduced to $^1/_4$-inch lump size by crushing or if too wet, an old-fashioned chopping bowl and knife will give quick and satisfactory results. Spread on a sampling cloth and quarter repeatedly until about one pound remains. When the six samples are thus reduced, assemble in a small enameled steel pan.

Water Content After weighing the sample, dry at 150°F maximum temperature, covering with a cloth to eliminate outside dust. After drying, reweigh, and determine percentage of water in wet clay weighed.

Sand Content and Size of Grain To 100 grams of representative material taken from the dried sample, add 1000 grams distilled water, and heat to 125°F or as warm as the hand can comfortably endure. Agitate until the clay is thoroughly disintegrated. Cool by placing the receptacle in a dish of cold water. Add ammonia, a drop at a time, until the clay is dispersed. Remove the sand by pouring through a 200-mesh sieve, washing the residue with a little distilled water and add washings to the original liquid. Agitate the clay water mixture thoroughly and classify by means of a Schultz elutriator.

Plasticity: Viscosity, Lubrication Values, and Bonding

I believe that general opinion holds that the peculiar and especial properties of ball clays are combined in two properties, *viz.*, greasiness or lubrication, and stickiness or bonding strength. By these the mass containing ball clay is caused to mold with increased smoothness and the strength in both the plastic and dry states is increased. Since ball clays are never used alone as ceramic bodies, the determination of these properties on pure ball clay has been unsatisfactory to many as a guide to industrial application.

Viscosity The determination of viscosity by means of the Marriot tube may have distinct value as a guide to the behavior of the clay in body and glaze composition but investigators

have not agreed on any values as standard based on data obtained with this apparatus. The following values obtained with this apparatus may prove of interest and value in this consideration.

The above values give American ball clays a higher viscosity than that of English ball clays. Some investigators have reported the reverse. I am convinced that no two operators will check on the viscosity value,

TABLE I

VISCOSITIES OF BALL CLAY-WATER MIXTURES
VISCOSITY OF DISTILLED WATER EQUALS 1.00

Clay	10%	20%	25%	30%	35%
Water	90%	80%	75%	70%	65%
		English Ball Clays			
A	1.01	1.05	1.12	1.26	1.46
B	1.01	1.03	1.06	1.13	1.33
C	....	1.01	1.04	1.09	1.19
D	....	1.05	1.09	1.17	1.33
E	....	1.04	1.07	1.13	1.33
		American Ball Clays			
A	....	1.06	1.13	1.32	1.90
B	....	1.05	1.12	1.25	1.54
C	....	1.05	1.16	1.41	....
D	....	1.09	1.18	1.22	1.34
E	....	1.10	1.20	1.36	1.54

except when working under exactly the same conditions. A difference in the time consumed in bringing the clay into complete suspension and the length of time it stands in suspension before test will make a difference of more than 10% in the values reported. This is especially true of ball clays because of their high content of adsorbed salts. It is, therefore, essential that if viscosity is used as a basis of comparison, a very definite testing procedure must be followed.

Lubrication Values Crush the dry sample until it passes a 20-mesh sieve. To one-half the dry sample add an equal weight of pulverized flint and mix thoroughly dry by screening repeatedly. To 100 cc. distilled water add this clay-flint mixture until the mass will hold its form perfectly and flow under pressure through an opening 1 x $^1/_2$ inch and emerge with smooth edges. Add flint plus 25% water until the edges of the bar produced no longer appear smooth. The percentage of flint added to the clay is the *lubrication value* and is expressed in per cent of dry flint added to 100% of dry clay.

Bonding Value This value of ball clay may be definitely determined on either the leather-hard or the bone-dry material in a number of ways. The accuracy of the data will depend upon two factors: (1) the uniformity of the test specimens, (2) the method of

test. Test specimens have been prepared in many different ways with the hope of producing a unit which will be free from laminations or other structural faults. The practice of hand molding has been proven absolutely unreliable. Casting was for a time considered but has not been generally approved. The most practical method is to produce a series of bars by the method employed for determining the lubrication value. The unused half of the dry clay sample is mixed with an equal weight of pulverized flint and the amount of water determined in the preparation of that mixture. This is made into bars by the method described and cut to 5-inch lengths. These bars, after being formed, are dried at 125° to 150°F. For leather-hard samples, the drying process is halted as soon as the pressure of the end of the finger will no longer produce a distinct impression on the surface of the bar. (Bars should be tested near the end, which is not included in the portion subjected to test.)

All cross-breaking tests are to be conducted on the Reihle testing machine, modified for cross-breaking tests, as employed in the laboratory of the Ceramic Station of the U. S. Bureau of Mines, Columbus, Ohio.

The leather-hard cross-breaking test should include a record of the load necessary to produce a distortion of $^1/_4$ inch in the center of the bar. If the time to this stage is recorded and the total time recorded, the proportion of the total load may be easily computed.

The dry cross-breaking test is conducted on bars which are dried to constant weight.

For accurate data the increase in load should not exceed 4 pounds per minute.

The cross-breaking strength or modulus of rupture is calculated by means of the formula:

$$M = \frac{3Pl}{2bd^2}$$

M = modulus of rupture
P = force applied or pressure in pounds
l = length between supports in inches
b = breadth in inches
d = depth in inches.

Shrinkages in Drying and Firing

At least three of the bars provided for the bonding value test should be carefully marked as soon as they are formed with scale for determining shrinkages. These are dried to the leather-hard stage and the shrinkage recorded. The drying is completed and the trials again measured. The shrinkage to the leather-hard and bone dry stages are expressed in per cents of the original length. The trials are then fired to cone 10 and the firing shrinkage is recorded in percentages of the dried lengths.

Color Value Ball clay should never be tested for color in the concentrated state, since its density and adsorbed salts give color intensities which are misleading.

The most satisfactory results are obtained by incorporating in a body consisting of standard materials as follows:

Potash feldspar 20%, flint 30%, English china clay 30%, ball clay to be tested 20%. This is fired at cone 10. The amount of ball clay introduced is excessive as compared to the average vitreous body but if reduced to 10 or 12%, the comparison of different clays is sometimes difficult.

For use in non-vitreous bodies, the color action may be studied in the mixture of 50% clay, 50% flint, but the data obtained cannot be readily compared to factory practice.

Vitrification Value The action of the ball clay as a flux may be studied very satisfactorily in the 50% clay—50% flint mixture, by determination of the absorption of the samples after being fired to cone 10.

Fusion Value This determination is the same as has been recommended by the Standards Committee for the test of all clays. The use of the 50% clay—50% flint mixture offers some advantages in this test and may be worthy of consideration as the rate of deformation is generally increased and the value may be more exactly determined.

Vitrification Range This consists of the range in standard pyrometric cones between the vitrification temperature and the deformation temperature both expressed in cone values. The determinations must both be made on the clay as marketed and care must be taken that the test specimens are absolutely representative. The mode of expression may, for convenience, be in cones arranged as a fraction, *e. g.*, $\frac{12}{28}$ meaning that the clay becomes non-absorbent at cone 12 and deforms at cone 28.

Development of Specifications

The development of specifications becomes a difficult task when we consider the importance which must be assigned to the various properties investigated.

The *chemical analyses* of dry ball clays has been found to vary within the following limits:

Ignition loss, 9% to 15%	CaO, 0.0% to 0.4%
SiO_2, 45% to 61%	MgO, 0.0% to 0.3%
Al_2O_3, 25% to 39%	K_2O, 0.4% to 2.0%
Fe_2O_3, 0.6% to 1.3%	Na_2O, 0.0% to 0.5%
TiO_2, 0.6% to 1.8%	

The *sand residue* (ignited) retained on a 200-mesh sieve has been found to vary from .5% to 12%.

The *grain size* of the clay passing a 200-mesh sieve has been found to vary between the following limits:

0.075 to 0.0175 mm., 2% to 7%
0.0175 to 0.0075 mm., 10% to 28%
0.0075 to 0.00175 mm., 45% to 65%
Smaller than 0.00175 mm., 7% to 40%

The *viscosities* of 25% ball clay—75% water mixtures vary from 1.04 to 1.20.

The *lubrication value* has been found to vary from 320 to 560.

The *bonding values* as indicated by the modulus of rupture have been found to vary from 160 to 470 pounds per square inch.

The *color value* has been found to vary from a commercial white through all degrees of gray, buff, yellow and brown. No definite scale of color values is offered.

The *vitrification value* of 50% clay—50% flint mixtures has been found to vary from 30% to 20%.

The *fusion value* on the clay alone is found to vary from cone 23 to cone 33.

The *vitrification range* has been found to vary between cones 11 and 18 for vitrification and cones 23 and 33 for fusion.

The limits or values are not definitely suggested since this is properly in the hands of the Standards Committee. It is probable also that they may recommend other tests than those here outlined but it would appear that the ball clay situation is sufficiently important to justify some attempt on the part of our SOCIETY to develop purchase and test specifications covering this material.

DEPARTMENT OF CERAMICS
OHIO STATE UNIVERSITY
COLUMBUS, OHIO

Discussion

MR. RIDDLE: We are overlooking something that is very important, and that is the question of moisture in content of clays. There are two or three producers and sellers here, and several consumers, and it is a fine opportunity to enter into a discussion and get some real value out of this paper. It might also be advisable to present our discussion to the Standards Committee and see what they would advise. If we do that, the selling agents and producers have an opportunity right here to say what they think as to how fair it would be to buy clays on a moisture-free equivalent base.

MR. HENDRICKSON: As producers we have numerous complaints. If the consumers would be willing to stand the expense, to get dry clays which

would entail a considerable amount of extra labor, equipment and handling that might solve the problem. Whether this amount would be more or less than the amount paid by the consumer on receiving the clay with more moisture than he thinks proper, is another question.

I do not think we have any figures on that subject. We know that in the winter months when the consumer does not have adequate storage space, sometimes he fails to order his material in sufficient time, necessitating mining under adverse weather conditions and at more than double the normal expense to the producer.

In the summer the consumers get a drier clay than they do in winter.

It would be an ideal thing if all ball and sagger clay mines had drying facilities and could ship dry clay. Some mines are not situated so as to have adequate space and buildings or sheds in which to dry (store) the clay.

It would cost the producers a great deal more money to have the dry clay, but if some way could be suggested and the potters could see the advantage and be willing to pay the extra costs we can see no reason why, if they want dry clay they cannot have it.

MR. METZ: A little incident in our business may possibly be of interest here.

A certain company which ships wet concentrates, averaging around 35% moisture, found that by installing driers to dry their material before it was shipped, and even with the additional cost of drying, it was possible to allow an over-all saving of 10% just on that one item. Considering how much they concentrate in their plants, that makes quite a saving.

Has any attempt ever been made actually to dry ball clay in a machine of that type? We have been drying clays for such concerns as Langley in South Carolina, Continental Clay Company, and there might be some possibilities in the ball clay industry in drying the clay in the same manner.

MR. GESNER: This is a problem like plasticity, you have to wrestle with it for some time before you determine what would be a suitable adjustment.

MR. BRIAN: To determine a standard amount of moisture, I think, would be impossible without consulting the producer in England as the moisture varies very greatly.

A few years ago on one of my visits to East Liverpool, I called at a particular pottery which had just unloaded a very large car of ball clay, on which they had one of their employees playing a hose. I asked, "What are you doing that for?" The answer was, "We soak all of our ball clay." I then asked what allowance they made for this moisture in their pottery. The answer was 20%. In other words mere guess work.

Some of my Company's consumers dry all of their ball clay before they use it. There are others who dry it and then grind it.

To my mind the only safe way to use ball clay is to use it in the dry

state; then you are quite sure of your moisture content, or in other words, as near as you can possibly come to it.

Ball clay as mined is ordinarily put up in large piles, and then awaits time of shipment.

In the section of England where this particular clay is mined they have considerable rain, particularly during the fall and early spring seasons. If I want this material I am compelled to take it, and make no complaint regarding the extra moisture in same.

Recently this Company received a shipment of ball clay that contained 36% of moisture which is entirely too high; 20%, however, is a fair average. I have often taken this matter up with the producer on the other side, but his answer has always been, "How can you change conditions?"

If storage cellars were put up it would simply mean that your company as importers and others would have to pay this additional charge. I think that Mr. Gesner of the Hammill & Gillespie Co., will quite agree on the above statement.

I would suggest that the AMERICAN CERAMIC SOCIETY put the matter of moisture up to the importers, and then in turn put it up to the producing company in England. If you will come as a SOCIETY I feel quite sure that you will have the hearty coöperation of every importer of ball clays.

This company is with the AMERICAN CERAMIC SOCIETY to the limit, and also with the pottery manufacturer.

When I was over in England last November, it rained nearly every day. This company has seven shafts in operation producing ball clay. Five out of the seven shafts sunk in on account of the rain. The average shaft produced about 80 tons of clay per week when working full time.

The thought that I want to impress upon you is regarding weather conditions in England. The proper months for the consumer to secure ball clay would ordinarily be throughout the summer months, from May to October, as ordinarily this season is drier than between October and April. Of course, they do have some heavy downfalls during the summer.

The clay mined during the summer when piled up becomes very dry, containing about 15% or 20% of moisture.

The shipment is desired by an American importer, and the mine proceeds to load the material by the railroad wagons which contain anywhere from four to twelve tons. The cars used are all open cars covered with tarpaulins. The cars are then forwarded from the mine to the dock to be loaded on the vessel. The clay may be practically dry when loaded, and sent down to the ship. After arrival at the dock the tarpaulins are all removed from the cars ready for shipment to the vessel.

It may be a beautiful day when the cars arrive at the dock, but within one half hour or so after the tarpaulins have been removed down comes the rain. You will, therefore, see that even if the clay is shipped fairly dry

to the dock, there is a possibility of the clay getting saturated by the heavy rains.

The English producer has stated that he will try to secure dry clay, but what is he going to do in a case like that just mentioned?

During the War when everyone was very anxious to get all the clay possible, this company received one lot of clay that came over very much saturated. I complained to the ship-owners and after considerable discussion and various cables to the other side, I was advised that they had to put water on the slide to force the clay down into the vessel. This was caused by the clay originally being too wet to run down the slide so a little more water added to that in the clay naturally assisted the clay to be forced into the hold of the ship.

PROF. WATTS: For a great many years I bought large quantities of ball clay, and I found there was no difficulty in securing ball clay with a moisture content of not exceeding 12%, provided I was willing to furnish storage space so that the ball clay could be shipped to my factory in the summer when the weather was good, and stored there.

In many plants that is very inconvenient because they have a certain place for ball clay and they do not want to go a quarter of a mile to get ball clay out of a shed and bring a carload of it in. It will probably mean that for materials such as ball clay and perhaps some American china clays it will be necessary to provide either additional space in storage bins at the factory or it will be necessary to recognize that the shipper must have storage facilities either at the plant or at the railroad where he can store his ball clay in such quantity that it will carry him through the winter months.

As a result of agitation which I developed with my sources of supply, we were able to arrange for a storage of ball clay at the bins, and it costs us about 10% more to have this clay stored at the railroad in sheds so that we can have dry ball clay. It costs us about 10% more for our ball clay. But we did not have to pay 25% more freight or pay for the handling of a lot of wet ball clay, and we were not annoyed with the problem of determining moisture on our different bins. We did not attempt to have the ball clay come down to zero moisture, but we did insist on buying ball clay on a certain basis. We had no difficulty with any ball clay shipper that we dealt with in reaching a satisfactory arrangement on the price of ball clay and we saved money on it.

I believe the same thing that we accomplished could be done by every other consumer of ball clay, if he will go at it in the right spirit with the miner.

As far as the English clay is concerned, I recognize what has been said with regard to the irregularity of the moisture content in shipments of English ball clay. I have been hearing that in increasing earnestness for

the past two or three years, and yet it goes without saying that ultimately the American consumer must pay the ocean freight on that water. The man who is handling the ball clay cannot afford to lose 36% on the price of his ball clay and 36% on the price of his transportation to New York.

The consumer has to pay for at least a part of that 36% moisture. Some constructive work could be done by our SOCIETY if we would take up this question of the water content which would be permissible and for which the consumer would agree to pay in the shipments of both foreign and domestic ball clay.

MR. ENGLE: Our firm is certainly willing to work along that line. We have often discussed the present very uneconomic practice of shipping clay three thousand miles by water and then several hundred miles by freight, and paying at least freight and many other charges on 10%, if not more, on water that should be eliminated.

Our English ball clay shipments run from 15% to 20% average moisture through the year, and they run higher when we have wet weather. The record of our last five or six shipments was around 16% or 17%.

It is not an easy thing to get the English clay mines to change their system of doing things, but I do not think that this obstacle is unsurmountable. I do not believe the English mines would dry our clay except the American consumers speak with one voice and that in a very determined manner.

CHAIRMAN BLUMENTHAL: We have heard from some of the producers and their willingness to coöperate. The SOCIETY will do all in its power to help all parties concerned. We ought to hear a few words from some of the consumers.

MR. STAUDT: There is no use wasting any time talking about it. Time is money. We have known this for years, we have been agitating for years and we have had trouble for years. We know we pay for 10% to 20%, and even as high as 25% of water.

Now, nothing is impossible. If we insist that we want to have our clay delivered with water content not more than 5% we can get it. But we do not stick together. As the Englishman says, "You have to take it, never mind whether it is 20% of water or 5%."

We bought some New Jersey ball clay at one time. There were three prices; one was for the clay that came from the filter press; one semi-dry and one bone-dry, the latter was the highest priced We ordered that bone-dry clay because it is very important for us that we keep our moisture content down. But we received semi-dry clay and they charged for bone-dry. We had all kinds of correspondence, and they said it must have got wet on the way. The result was I paid for the bone-dry clay, got the semi-dry and had to dry it; had a whole lot of trouble, and paid my bill. And ever since we have done the same thing; have simply paid for water.

Mr. Hendrickson: Mr. Staudt, how far ahead do you anticipate your supply?

Mr. Staudt: We do not anticipate a supply very far ahead.

Mr. Hendrickson: I was not criticizing Mr. Staudt's manner in ordering his clay but if the clay consumer would give plenty of time when ordering the clay, he would undoubtedly get drier clay. If the consumers would send their orders in far enough ahead to give the producer a chance to get his orders in, I believe some of the difficulties would be overcome.

Chairman Blumenthal: The producers and importers and the consumers should get together with the Standards Committee on this proposition and see whether it cannot be worked out. I am sure that it can, because with the coöperation afforded in all branches concerned this matter can be brought to a definite understanding.

Mr. Riddle: I move that a committee be appointed by the White Wares Division to go over the details of the discussion and then present its findings and advice to the Standards Committee, and that this Committee be composed of one whom can be called neutral, and three consumers and three producers, Professor Watts to be neutral and to pick his own six men. (Motion duly seconded and carried unanimously.)

Mr. Gerber: Essentially, the great objection to moisture in clays is in the disturbance it may create in mixes when the water content varies. This certainly can be avoided very largely, by stocking clay in advance of requirements. If stored indoors the clay will gradually dry to a uniform state; if stored outdoors it can be brought in, in time to dry to the proper state. Where the user is acquainted with mining conditions, and inadvertently places rush orders during wet seasons, his lament when the clay comes soaked is scarcely in good form.

Against the uneconomic payment of freight charges on water, the clay worker to be sure has the redress of passing it on to the consumer. This admittedly is a left-handed means of escape, and yet it may easily be a debatable question whether in a great many instances the charges incidental to drying would not exceed the freight on a reasonable content of water. Inasmuch as a reasonable percentage of water is not detrimental in the uses to which clay is later put, why not leave it and arrange a scale of prices based on moisture content. Raw materials in which the presence of water is perhaps more disadvantageous than in clay, *i. e.*, iron ore, coal and coke are widely bought and sold on a dignified plane which takes into account water content. The crux of the matter is not so much the mere presence of water, nor the need of paying for water, but rather the fact that under existing conditions both of these circumstances rest on a structure of guesswork.

FELDSPAR MILLING

By W. H. Landers

A study of the monthly quotation of prices asked for crude feldspar in all districts, will demonstrate that the miller is paying more today for the rock he mills, while he has difficulty maintaining last year's prices for the ground rock he sells.

This condition is due primarily to a lack of sufficient labor at reasonable compensation, and the exhaustion of the near-by deposits of high grade mineral. The consumer can have little comfort in the situation from the standpoint of quality and price, but he has a perfect right to demand constancy in quality of milled product.

The miller must be able to draw his supply of crude feldspar from mines in the same district, and put through his plant, a definitely proportioned mixture of rock from each source, or he must have a single deposit large enough to keep his plant supplied.

He must also be constantly on the alert to see that the rock is properly sorted both at the mine, and at his mill. Conditions in each mine are liable to change from time to time, and the effect of such changes must be anticipated and provided for.

Recognizing that good rock is scarce, and labor is inefficient and high priced, the miller must have his equipment in the best of condition to produce a satisfactory and uniform product. The days when the boss miller could tell from the "feel" or "taste" of the rock that it was properly ground, have passed. The miller must have knowledge of the use of screens, test mills and other simple laboratory appliances.

The last condition is really the only one within control. Mills can be designed, built and maintained in such a manner as to reduce to a minimum the skilled labor, and can be counted on to turn out continuously a far more uniform product than was ever possible on the old-style intermittent types.

Whether or not a new piece of machinery will take less power, cost less for repairs, or is justified in its first cost, is of little importance compared to the question as to how many men it will save, and how uniform and continuous is its output.

Dry Milling Methods

All of the old-style intermittent plants are not without improvements. One now finds rock breakers in place of hand sledging, automatic feed and discharging of the chaser mills, mechanical elevation and screening, automatic return of over-size, and various mechanical conveyors of the chaser stone product to storage, and batch grinding finishing mills. The small batch mills have in some places been replaced by the larger tube

mill, generally operating as an intermittent grinder. Bins for storing the chaser mill feed, or final shipping product are occasionally found.

The highest development of feldspar milling using only apparatus now thoroughly tried out on this class of rock, would consist of the following equipment:

ROCK CRUSHER to 1″

ROLLS to 1/4″

MAGNETIC PULLEY (to eliminate iron from crude ore, crusher and rolls)

STORAGE BIN

AUTOMATIC FEEDER

PEBBLE MILL (PRIMARY)

VIBRATING SCREEN, 6 mesh (Oversize returned to mill)

AIR CLASSIFIER, set to size desired between 80 and 150 mesh

OVERSIZE TO BIN FINISHED MATERIAL TO STORAGE BIN

AUTOMATIC FEEDER

PEBBLE MILL (FINISHING)

AIR SEPARATOR

OVERSIZE RETURNED TO MILL FINISHED MATERIAL TO STORAGE BIN

TO CARS or AUTOMATIC BAGGING MACHINE

Chaser mills, in spite of their simplicity and small power requirements for primary grinding are gradually giving way to the continuously fed pebble mill. Although the pebble mill requires preliminary crushing, it takes less mill space and can be maintained at its highest grinding efficiency with less loss of time, money and labor, than can the chaser mills.

With the advent of the pebble mill as a primary grinder, came the vibrating screen for elimination of coarse over-size preparatory to the final grinding in the batch-finishing mill. As the use of vibrating screens developed, it was found possible to eliminate the finishing mill, when grinding to the 100-mesh for the glass and enamel trades, although finer screening to the 140-mesh pottery trade requirements could not be economically performed by screens alone.

The next step in improved milling was the air-classifier. With this the costly and troublesome fine screens were dispensed with and continuous grinding made possible. Any size product, between 80- and 150-mesh could be continuously produced with the use of one or more pebble mills attended by one man only.

A big saving in power was now possible, particularly where a small output of 3 to 4 tons per hour of 150-mesh material, was desired. This saving while not apparent when the pebble mill was used only as a primary grinder, resulted from the elimination of the batch mills or dump cylinders. Feldspar fed to the batch mills contains approximately 85% of finished material, and it is necessary to grind the entire volume for from 4 to 8 hours finally to finish the 15% of over-size. The classifying apparatus enabled the finishing mill to receive a feed containing only 10 to 20% of finished fine feldspar.

This flow sheet assumes that the crude feldspar contains less than $^1/_2$% of moisture. If this condition cannot be maintained, a small drier should be placed between the storage bin and preliminary pebble mill, or a larger drier between rolls and bins.

Such a plant can be operated by one mill man and a helper, a crusher man (one shift only) and two baggers (when shipping bagged material) and can turn out four tons an hour of 150-mesh feldspar.

Maximum Service with a Minimum Loss of Time and Repair Cost

1. Many old tube mills now operating as dump cylinders, are susceptible of conversion to continuous grinders.

2. Jaw-crushers are less expensive to buy and maintain than gyratory crushers taking the same size feed. A crusher sufficiently large to avoid hand sledging of mine rock fed to it, should be used. It is cheaper to break rock in a crusher than to do it by hand.

3. The run of mine size should not be reduced in one operation to the

small size necessary for a pebble mill. A set of rolls or specially designed gyratory fine crusher will give better satisfaction.

4. Feldspar, although one of the easiest hard minerals to break, or pulverize, is extremely abrasive and will quickly wear out any machine operating with a rubbing motion and contaminate the product with the metal.

5. Rolls if used should be big enough to nip the largest piece fed to them without undue slippage. Speed is a very important factor.

Rolls should not be expected to reduce at a greater ratio than 4 to 1.

6. Manganese steel crusher jaws or roll shells should not be used, as the following magnetic pulley will not attract manganese steel particles. Chrome is better.

7. Belt conveyors are better than bucket elevators on all material larger than 20-mesh. Bucket elevators, if necessary, should be of the belt type, and for the coarser crusher product of the continuous bucket type. Chains should never be used in material as abrasive as feldspar.

Belt conveyors avoid all such troubles and are nearly fool- and wear-proof, if properly installed.

8. A high intensity magnetic head pulley on a belt conveyor, will remove much of the mill and tramp metals.

9. Room for a good big bin to hold at least 24 hours feed for the primary grinding mill is advisable. The crusher and rolls can then be operated one shift only, and this department will be independent of the rest of the plant.

10. An automatic feeder should be installed to control feed to primary mill. The feeder usually attached to the feed end of a pebble mill is for putting feed into mill only, not for measuring its quantity.

11. Care should be taken in selecting the primary mill. Slight differences in design may affect the output as much as 30% in the case of pebble mills.

12. Except in the cases of very small installations, the primary mill should not also be a finishing mill. The two operations require different sized pebbles and consequently different sized feeds.

13. A small bin ahead of finishing mill, if possible enables repairs to be made to any part of the plant, without closing down the entire mill.

14. Sufficient storage should be provided for finished material to be independent of car supply or other transportation difficulties.

15. Grease lubrication as far as possible is best as oil is wasteful and requires more attention than it is likely to get in a dust-laden atmosphere.

16. Daily screening tests, backed up by frequent fusions and analyses of the mill product, are necessary to a uniform and satisfactory product. This does not cost as much as losing customers and reselling rejected shipments.

Wet Milling

There is an almost unlimited quantity of feldspar available in the United States suitable from an alkali and alumina standpoint, but which contains sufficient garnet, hornblend, tourmaline, iron-oxide, etc., to make it unsuitable for use by the potter. Such material can be so cleaned as to give it a final quality equal to the best grade.

As the remaining first class quarries are worked out, the miller (always ultra-conservative) will be forced to turn his attention to making an acceptable product out of this lower grade feldspar. The consumer will need to coöperate in this development if there is to be any hope of lower or even equal prices for feldspar in the future.

At least one large mill has been wet grinding and cleaning feldspar in this country, while in England and Continental Europe, wet milling without cleaning, has been a regular practice for years.

From data now available, the flow sheet of such a wet grinding mill, using only standard equipment, would be as follows:

ROCK CRUSHER to 1″

ROLLS to 1/4″

MAGNETIC PULLEY

MILL BIN

AUTOMATIC FEEDER

PRIMARY PEBBLE MILL

CLASSIFIER to 30 mesh
Oversize returned to mill

CLASSIFIER OVERFLOW to
30 mesh screen to eliminate
coarse mica, chips, cinders, etc.

CONCENTRATING TABLES to remove iron bearing minerals

CLASSIFIER to desired mesh of finished material

OVERSIZE to regrinding pebble mill in closed circuit with this classifier

FINISHED MATERIAL to continuous thickener

CLEAR WATER overflow returned

THICKENED MATERIAL to

STEAM OR OIL HEATED FILM DRIER

DRIED MATERIAL to disintegrator and then to vibrating screen to remove any lumps

FINISHED MATERIAL to storage bin or bagging machine

The number of men required to operate a wet mill would be the same as in the dry milling plant, with the addition of a drier man. Its cost of operation would be slightly higher on account of the extra drying cost. As a partial offset to this would be the saving in dust losses and repairs.

Wet milling of feldspar is not revolutionary. Most of the flint used in the ceramic industry is secured from the wet grinding of quartzite in iron or steel mills. Little or no effort is made to prevent contact of the wet rock with the metal grinding material.

The subject of feldspar milling needs careful consideration. A little time and expense for research work before adopting this larger and more costly construction will repay the small cost involved.

4 West 43rd St.
New York City

REFRACTORIES QUESTION BOX[1]

E. E. Ayars, Editor

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?

2. What difference is there between the properties of a soft mud machine made and a hand made brick?

[1] See note, *Bull. Amer. Ceram. Soc.*, **3** [7], 258(1924).

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Question

What effect do sand and oil inclusions incident to hand molding have on the service of hand made fire brick?

Discussion

In the manufacture of fire brick by the soft mud hand repress method, one brick out of every three contains sand cracks due to the fact that the third brick is made from the caps from the two previous brick.

Some recent tests show that these sand cracks cause the brick to spall.

SPALLING TEST

Brick free from sand cracks	Brick with sand cracks
Lost 2% on 10 dips	Lost 3% on 10 dips
Lost 2% on 10 dips	Lost 3% on 10 dips
Lost 3% on 10 dips	Lost 10% on 10 dips
Lost 3% on 10 dips	Lost 60% on 8 dips
Lost 3% on 10 dips	Lost 10% on 10 dips

In service the brick with sand cracks spall considerably more than brick free from sand cracks.

Oil is even more sure to cause spalling than sand. We have some photographs in our laboratory showing how brick with oil cracks behaved in the reheating test preliminary to a spalling test. They were cracked to pieces and when the same brick were put in service in a boiler furnace they spalled badly. Brick free from oil cracks placed in the same furnace did not spall.

We are therefore of the opinion that fire brick would give much better service if they could be made free of sand and oil cracks.—C. E. BALES, Louisville Fire Brick Works.

Question

What is the cause of the rapid failure of fire brick in the checkerwork baffles of oil fired boilers, subjected to a temperature of 2300°F but against which the flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this the result of reducing conditions?

Discussion

The effects noted on the checkerwork baffles of the oil-fired boilers is probably chiefly due to the fluxing action of alkalies in the oil. Practically all the fuel oil from the mid-continent fields has a quite substantial content of alkalies which are either originally present in the oil or added by the refiners in the process of distillation. These alkalies have a strong fluxing action on fire brick especially those of a siliceous nature. The action is much less marked on fire brick composed of flint clays without any excess of free silica.

The heavy Mexican oils (12 to 16 gravity Bé.) do not appear to have the alkali content of the mid-continent oils either because they do not have it in the first place or because owing to the fact that they are merely topped for gasoline and not used for the distillation of lubricating oils, it is not added by the refiners.

The effect in the case under consideration is probably made still worse by strongly reducing conditions from time to time. Failure will always take place at a lower temperature under reducing than under oxidizing conditions.—PHILLIP DRESSLER, American Dressler Tunnel Kiln Co.

It does not appear at all likely that there is any time when a reducing condition exists in the checkerwork baffles of a boiler, as it is through these checkers that the air to support combustion enters and the flame burns several inches above the grate line. There should be an excess of oxygen at all times in and around the checkers.

The alkalies in the oil seem to be the cause of failure.

The following data on oil fired boilers is of interest. One large southern electric power company is firing a 16 gravity Bé. topped Mexican oil. The boilers are a Babcock and Wilcox three pass, horizontal tube with lateral drums. The combustion chamber bottom is so designed as to eliminate as much as possible the slagging of checkerwork baffles. Back shot burners are used. These project from the bridge wall and the flame is directed toward the front wall of the boiler, air being admitted through the checkers under the flame. Less than half the area between the front wall and bridge wall is given over to checkers, and these lie directly against the front wall. The rear section of the bottom lying against the bridge wall is made up of old brick laid in loosely, the surface sloping gently toward the checkerwork. At the junction of checkerwork and sloping bottom a slag dam is built. This catches the slag which runs from the fur-

nace walls and prevents such slag from getting to the checkerwork. The slag and loose brickwork is easily removed, without damage to the checkers. It requires six months to a year for the slag pocket to fill.

The only trouble with slagging in the checkers is occasioned by oil dripping directly on them from a poor burner, and this does not often occur. However it should be noted that if the oil does have access to the brick for very long they will slag badly.

Brick in use are from one Missouri manufacturer and from one manufacturer in the Olive Hill, Kentucky district. Good service is obtained from either. Both dry press and hand molded brick have been used but no apparent difference in service is noticeable. The dry press brick lay up into a better looking wall as far as joints are concerned and are on that account used more than the hand made product. It has been found that the usual prejudice against dry press brick in oil fired furnaces has no support in actual service in this case at least. The clays employed in making the brick have more to do with the service than the method of manufacture, or at least the method of manufacture does not appear to effect the service. The brick are laid with a thin joint. Some commercial fire cements and washes have been applied to the walls with more or less success but are not found necessary to secure good fire-brick service.

In early installations the wall construction consisted of four header courses and one stretcher course. Insufficient expansion joints were allowed and the side and front walls showed a tendency to split through the middle, half of the wall falling into the fire-box. The bridge wall also split in two parts. The use of large anchor tile did not prove effective in correcting the trouble.

Latterly by changing the wall construction to alternate header and stretcher courses, and making a more liberal allowance for expansion this fault has been overcome.

The chief engineer expressed the opinion that with a good first quality brick the matter of service depended more on the design, construction and operation of the installation than anything else.

Constant changes are being made in their equipment of 10 boilers to secure the best efficiency, the principal one of which consists in raising the entire boiler several feet above the flame. Greater fuel efficiency will result with redesign of the boiler setting. The steam atomizing burners will be replaced by mechanical burners, which will also improve the combustion conditions.

The opinion has been expressed that the new installation will be more severe on fire brick than the present one on account of the extra weight of the setting. This will undoubtedly cause bulging and some chipping of brick when the wall is heated up. To offset the effect of pressure at high temperatures, the erosion effect of the steam and oil blast will be elim-

inated by the use of mechanical burners and there will be less slagging. Without doubt the brick now in use will be absolutely satisfactory inasmuch as the temperatures will go no higher (3000° to 3100°F) than they do at present and there will be less local heating effects to meet in the higher setting.

It has been noted that soot deposits have more or less effect on brick, as well as on the boiler itself. Soot forms in various places when burners fail to work perfectly.

When the boiler is taken off and cooled moisture collects in the soot combining with it to form sulphuric acid. The acid attacks the brickwork, eating through the glazed surface and forming a rotten spongy mass which is easily scraped away. Eventually the thickness of one or more brick over the area affected may be destroyed by recurring deposits of soot.

Another public utilities plant is equipped with 600 h.p. Edgemoor cross drum boilers set 13 feet, 9 inches above the floor line clearing grates 11 feet, 9 inches. These boilers are fired with rear shot steam atomizing burners set in the front wall. Mexican topped fuel oil of the following specifications is used. Gravity 16 Bé.; viscosity (Engler) at 100°F barely fluid; as 212°F 9.55; flash point 285°; sulphur $1\frac{1}{2}\%$ to $2\frac{1}{2}\%$; water and sediment less than 1%; B.t.u. per pound 18,000. No analysis of salts and alkalies is available.

The refractories used are furnished by a Missouri producer.

The 9-inch brick of which the entire fire-box lining is made are laid up in fire clay slip with a thin rubbed joint. The clay was furnished by the brick manufacturer.

During three years of service with the boilers averaging 300 per cent efficiency not a single fire brick has been replaced in the fire-box lining. No spalling has been noted and no slagging or erosion of the walls has occurred. They are now in perfect condition. There have been no replacements of brick in the bridge wall to date.

The checkerwork baffles are placed under the flame only and fan out toward the bridge wall. The idea is to supply a definite amount of air to all parts of the flame. There is no slagging, except that caused by a bad burner occasionally, and the only replacements have been occasioned by breakage while cleaning.

It is interesting to note that in the two cases cited above both companies have been using the same brick and the same fuel oil. One boiler is equipped with rear shot burners while the other uses the back shot burner. The main cause of failures in the first case is method of wall construction and lack of proper expansion allowance. It appears that the back shot burner is more severe on refractories than the rear shot burner inasmuch as the first case has a history of considerable slagging, even in short runs, while the second case shows none in three years service. The fact that the boilers of the first case were set low, especially early in the

game, has some bearing on the slagging of the fire-box lining and shows the effect of local heating.

From the experience of the second company with their original high settings it would appear that refractories service will be less severe with high settings than with low, in spite of the somewhat greater pressure on the brickwork. Without doubt the effects of vibration on the setting will be more marked in the case of a high setting.

Mexican fuel oil contains little alkali but carries a high percentage of sulphur. As a result there is more corrosion of steel and brickwork than with most other fuel oils, but less fluxing action of alkaline residue on the refractories. According to information furnished by a large oil company the mid-continent fuel oils are rapidly disappearing from the market and Mexican oils will soon be used exclusively, except in the case of various large consumers of lubricants whose fuel oil requirements have been contracted for some time in advance by the companies furnishing their oils and greases. Thus it appears that the undesirable oils from the standpoint of refractories service will be automatically eliminated. Some experiments have been tried using commercial high temperature cements for laying mortar and patching. These trials have met with more or less success but the cements have been no more satisfactory than the prepared clays furnished by the brick manufacturer for such purposes.

The work of the Navy Fuel Oil Testing Station on selection of fire brick for marine purposes of the Navy is valuable to all power plant consumers of fuel oil. Any brick passing the Similative Service Test should give satisfactory service in power plant service, as marine service appears to be easily the more strenuous of the two. Placing a boiler in, or taking it out of, service and operating it at various capacity ratings, contributes more to refractory lining failures than continual operation at high ratings of efficiency. The power plant should therefore have excellent results with any brick acceptable to the Navy.

Some interesting data, collected by the Navy Department, appeared in an article by Norton and Porter, "The Method of Selecting Refractories for Marine Purposes of the Navy."[1] The average chemical analysis, weights, colors, grog sizes and fusion points of brick which passed the Similative Service Test are summarized, together with some reasons for failures of brick which did not meet requirements. Readers should refer to this article and review the data set forth.—Ed.

Brick for Oil-fired Boiler Furnaces

Fire bricks to be used in oil-fired boiler furnaces should be able to withstand extremely high temperatures, changes in temperature, should undergo

[1] *Jour. Amer. Ceram. Soc.*, **7** [7], 575–582(1924).

no volume changes in service, and should be uniform in chemical composition, physical properties and dimensions, especially in thickness.

The fire clay fields of Eastern Kentucky produce flint, semi-flint and plastic clays. It has been pointed out by various investigators that the refractoriness of a brick depends upon the heat resisting ability of the bond clay and as the Kentucky semi-flint clay has the same fusion point as the flint clay, it is very evident that a much better brick should be made from semi-flint clay than from flint and plastic clays. Furthermore, the semi-flint clay in Kentucky is much more uniform in composition than the flint.

We have found that semi-flint clay made into brick by the dry press process gives a product that gives excellent results in oil-fired furnaces. The properties of the brick are as follows:

Screen analysis	
Retained on No. 10 sieve	3.6
Retained on No. 20 sieve	21.9
Retained on No. 40 sieve	13.0
Retained on No. 60 sieve	7.3
Retained on No. 100 sieve	7.6
Passed through No. 100 sieve	46.6
	100.0%

Chemical analyses	
Silica	52.28
Alumina	42.54
Iron Oxide	2.10
Titania	1.52
Lime	0.38
Magnesia	0.40
Alkalies	0.80
	100.02%

Fusion point—Cone 32–33
Spalling test—Loss on 10 dips—8%
Compression in load test—4%
Mobulus of rupture—1648 lbs. per sq. in.
Porosity—17.55%
Absorption—8.13%
Apparent density—2.20
Reheating test 0.00 to 0.12% expansion

The U. S. Navy Department has used this type of brick in oil-fired furnaces for several years and the Argentina Navy is using these brick at the present time. A great many sugar mills in Cuba are also using these brick in oil-fired boiler furnaces.

The writer recently saw some oil-fired boilers where the conditions were very severe. They were rated at 750 h.p. but with the type of oil burner used, they could be raised to 1000 h.p. in 15 minutes. Needless to say such a high temperature necessary to produce so much steam is very destructive to the fire-brick lining. In this case a dense dry pressed brick far outlasted hand made bricks.

In general, it would seem that a brick to be successful in oil-fired furnaces must be dense, hard burned and made from highly refractory clays.—C. E. Bales, Louisville Fire Brick Works.

THE CERAMIC INDUSTRY IN CZECHOSLOVAKIA

BY RUDOLF BARTA[1]

Raw Materials It was the great riches in excellent ceramic raw materials which enabled the Czechoslovak ceramic industry to become an important factor in the international market. One of the most important Czechoslovak raw materials is china clay. The yearly production is about 400,000 tons and therefore Czechoslovakia is one of the largest china clay producers in the world. Well known is the china clay of Sedlice (Zettlitz) near Karlovy Vary (Carlsbad). It is almost kaolinitic, and is distinguished by wonderful plasticity. It contains about 99.3–99.8% kaolinite and its chemical composition is as follows:

	Per cent		Per cent
SiO_2	45.92	CaO	0.15
Al_2O_3	38.17	MgO	0.11
Fe_2O_3	0.50	KNaO	1.10
TiO_2	0.05	Ignition Loss	13.95

China clays are used for porcelain, faience, paper and ultramarine. In 1922 218,472 tons were exported.

There are the refractory clays and ball clays from Vildštajn Líšany (Lischnitz), Měcholupy (Michelob), Blansko, etc., for domestic consumption and export. The Germans, Austrians, Magyars and the states of the Little Entente cannot do without them.

Czechoslovakia produced 500,000 tons of refractory clays, of which 112,000 tons were exported in 1922. The best clays, the refractoriness of which is cone 35, have chemical composition as follows:

Clay	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	KNaO	Ingition Loss	Cone
Vildštajn	46.35	38.77	1.11	....	....	0.33	13.44	35
Měcholupy	46.42	36.67	0.56	....	....	....	15.68	35
Líšany	46.05	38.19	1.29	....	....	0.63	13.80	35
Blansko	50.03	35.29	1.57	0.42	0.49	0.50	12.05	34

Basic refractories are produced of 80% shale and 20% plastic clay. The best shale is of Rakovnik. It is in great export demand. The yearly production is about 500,000 tons. The largest customer is Germany. The shale of Rakovnik is distinguished by a high amount of alumina. It has a refractoriness of cones 36 and 37. The shale of Janušov in Moravia is bauxitic with refractoriness of cone 37.

The chemical composition is:

Shale	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	KNaO	Ignition Loss	Cone
Rakovnik	52.50	45.22	0.81	....	....	0.50	0.78	36
Janušov	43.38	42.07	0.80	0.18	0.20	0.21	14.25	37

[1] Secretary of the Czechoslovak Ceramic Society.

Silica Brick These are produced of glacial quartzites found in northern Bohemia. Bohemia is noted for its excellent silica brick. This bespeaks the excellent quality of Czechoslovakian silica refractories. It is in great demand abroad. The Czechoslovakian factories mix several kinds of quartzites, including those of the Silur formation.

The silica brick have a volume variation of only about 1%. The chemical composition of a glacial quartzite is as follows:

	Per cent		Per cent
SiO_2	97–79	MgO	0.19
Al_2O_3	1.41	KNaO	0.39
Fe_2O_3	0.13	Ignition Loss	0.25
CaO	0.11		

Magnesite Refractories World known is the Czechoslovakian magnesite. Before the War it was sold in international market as Austrian magnesite. The yearly production is about 10,000 tons, of which 30% is exported, principally to America. The chemical composition of a calcined magnesite is:

	Per cent		Per cent
MgO	87.60	SiO_2	3.03
CaO	2.25	R_2O_3	7.12

Feldspar Czechoslovakia is after America and Scandinavia the world's greatest producer of feldspar. 30,000 tons are produced yearly. 6521 tons were exported in 1922. The Czechoslovakian feldspar is mostly the veiny orthoclase of a great purity. The best is from the country of Meclov. Its composition is:

	Per cent		Per cent
SiO_2	63.78	MgO	0.07
Al_2O_3	21.41	K_2O	12.45
Fe_2O_3	0.15	Na_2O	1.25
CaO	0.12	Ignition Loss	0.29

Ceramic Products Porcelain is made in 70 larger factories and in many smaller ones. Faugeron tunnel kilns are used for biscuit and Fürbringer kilns for glazing. Yearly production is about 50,000 tons.

The insulators of Czechoslovakia have dielectric resistance to 200,000 volts.

Refractories Gas kilns are most used. The annual production is about 80,000 tons of which 44,716 tons were exported in 1922. Czechoslovakian specialty is refractories for high temperature furnaces.

Wall tiles and stove tiles are produced in 20 large factories and in many smaller ones. Annual production is about 20,000 tons. Some of these tiles are produced largely from china clay, others of clay mixtures. The first firing is made in periodic kilns and the second in muffle or tunnel kilns. They are exported to the whole world.

Floor Tiles These are produced without admixture from a clay from Breštany. Its composition is:

	Per cent		Per cent
SiO_2	64.49	CaO	2.70
Al_2O_3	10.70	MgO	0.34
TiO_2	0.51	KNaO	2.81
Fe_2O_3	1.51	Ignition Loss	7.90

The normal sizes of floor tiles are 15×15 cm.

Sewer pipes are made in 16 large factories, the annual production is 5500 tons, of which 4100 are exported. The pipes are glazed inside with clay-glaze and whole with salt-glaze. They are exported principally to the Balkans, Austria, Poland, Magyarie, Roumania and Turkey.

Brick and Tiles Aluvial clays, slates and loess are used in the production of building brick and tiles. The size of the brick are 29×14.7 cm or $24 \times 12 \times 6$ cm. Face brick are seldom made. The yearly production is about 2,000,000,000 brick and more than 200,000,000 tiles. They are exported to the neighboring states.

Cement is produced in 12 large factories with yearly capacity of 1,000,000 tons of Portland cement and of 200,000 tons of other kinds of cement. In 1922 there were exported to Germany, Austria, Holland, South America and English and Dutch colonies 32,342 tons of Portland cement and 7155 tons of other kinds of cement.

It is clinkered in rotary kilns. Kilns with automatic grates are being used lately for producing cements.

The special cements of Czechoslovakia have a strength 500 kg./cm. in two days.

Lime More than 300 lime factories burn about 90,000 tons of lime, of which about 10% are exported to Magyarie and Germany. The best limes are from the neighborhood of Praha.

Instruction and Science

In Czechoslovakia ceramics is taught in 2 high schools in Praha and Brno, in 5 industrial schools in Bechyně, Plzen, Telc, Teplice and Znojmo.

The most important scientific institution is Institute for the Silicate Industries, conducted by Professor Dr. Ing. O. Kallauner in Brno. It ranks with the best in Europe.

There are also the Institute for Glass and Ceramics at the Polytechnic School in Praha, conducted by Professor Dr. Ing. J. Burian, and the Station of Portland Cement Manufactories in Brno.

The technical sections of Union of Brick Industries, Union of Lime Industries, Association of Cement Manufactories, and ceramic group of Czechoslovakian Manufacturers are engaged in scientific work.

The standardization is done by Czechoslovak Society for Testing Materials, especially in the section II geologie, III stones, IV ceramics.

Ceramic section of Massaryk Academy of Labor conducts apprenticeship courses.

Some months ago the Czechoslovak Ceramic Society was founded, similarly organized as the American and English Ceramic Societies. It has the support of all ceramic activities, educational and trade.

Among the noted scientific workers in Czechoslovakia are Dr. Ing. O. Kallauner, Dr. Ing. Jos. Matějka, Dr. Ing. Jar. Matějka, Dr. Ing. J. Burian, Dr. Ing. J. Preller, Dr. Ing. F. Fischer, Ing. K. Hineis, Ing. J. Brabec, Ing. Stašek, Ing. Svoboda, Dr. Ing. Simáně and Dr. Ing. R. Barta; in ceramic raw materials, Ing. Splíchal, Ing. Purkyně and Ing. Gaertner, etc.

ACTIVITIES OF THE SOCIETY

MEMBERSHIP WORKERS RECORD

	Personal	Corporation		Personal	Corporation
Charles A. Bloomfield	1		Frank G. Roberts	2	
George P. Fackt	1		John Sawyer	1	
C. W. Fernholtz	1		C. Saxton	1	
H. A. Huisken		1	Frederick Stanger	1	
R. M. King	1		Office	4	1
A. Malinovsky		1		—	–
W. G. Owen	1		Total	14	3

NEW MEMBERS RECEIVED FROM JUNE 15 TO JULY 15

PERSONAL

Beebe, Alan P., 729 Meldrum Ave., Detroit, Mich., Secy., Peninsular Grinding Wheel Co.

Cady, Clifford C., 2806 W. Ave. 33, Los Angeles, Calif.

Cathro, Samuel P., Box 427, Santa Monica, Calif.

De la Mora, Victoria, Balderas 44, Mexico D. F., Chief of the Ceramic Division, Laboratorio Industrial Experimental.

Goudy, Harry C., 707 Arlington Ave., Baltimore, Md., Charge of Enameling Dept., Baltimore Gas Appliance & Mfg. Co.

Goulding-Brown, H., 28 Titchborne St., Hyde Park, London, W 2, England, Consultant for Technical Publicity, Borax Consolidated, Ltd.

Griffiths, Wm. G., Oak Hill, Ohio, Secretary and General Manager, The Pyro Clay Products Co.

Johnson, Oscar H., ℅ Mine & Smelter Supply Co., Denver, Colo., Manager Marcy Mill Dept.

Keenan, John F., 408 21st St., San Diego, Calif.

Krausse, Charles C., Cons. G. E. L. & P. Co., Lexington Bldg., Baltimore, Md., Supt., Industrial Fuel Sales.

MacGee, Alfred E., 1501 Neil Ave., Columbus, Ohio, Student.

Morgan, Charles N., 357 First St., Troy, N. Y., President and Manager, McLeod & Henry Co.

Morse, George T., 502 George St., New Brunswick, N. J., Sales Representative, Enterprise White Clay Co.

Stimpson, Clarence A., ℅ Chicago Pneumatic Tool Co., Century Bldg., Chicago, Ill., Special Representative.

CORPORATIONS

Chicago Hardware Foundry Co., N. Chicago, Ill., J. A. De Celle.

Los Angeles Gas & Electric Corp., Aliso and Center Sts., Los Angeles, Calif., M. J. Cereghino.

Washington Iron Works, 1141 Mateo St., Los Angeles, Calif., E. H. Graham.

1924 SUMMER TRIP TO WEST COAST

As announced, this trip has been postponed. Decision to postpone was made with profound regret by President R. D. Landrum and General Committee Chairman Fred B. Ortman. Their decision was based on the scarcity of reservations by eastern

ceramists of position and note. The wonderful entertainment planned by our western members would not justify anything short of a liberal representation of eastern ceramists.

After the decision had been made and before the notice of postponement of the trip could have been received by the members four additional prominent ceramists asked for reservations for themselves and wives. Perhaps the postponing was too hasty but without reservations in hand on time schedule after the advertising efforts that were made and especially after the most excellent boosting by all of the ceramic trade papers, surely no one could blame Messrs. Landrum and Ortman.

But there is going to be a summer meeting in Los Angeles this fall. Two days of technical sessions and pleasure trips; feasts for the minds and the tired bodies; a real vacational meeting of men together having like industrial problems. All of this and more is the promise made by Fred Ortman in the name of his western colleagues. Notice of this meeting will be mailed immediately on receipt of schedule from the western committees. Excursion rates will be in force through October. The western members have written that their cordial invitation to their eastern fellows continues. A cordial welcome will be given at any time to anyone who has his Society membership card but a more enjoyable and more profitable time will be yours if you will plan to meet them in Los Angeles when the western members will have their special "open house."

NOTES AND NEWS

REPORT OF THE PRELIMINARY ORGANIZATION MEETING OF THE CLAY PRODUCTS INSTITUTE

Held in the Hotel LaSalle, Chicago, July 8, 1924

Following a meeting of the representatives from the various clay products industries at Washington on May 2nd and pursuant to a call by Mr. R. D. T. Hollowell, Acting Secretary, a meeting was held at the Hotel LaSalle, Chicago, July 8th at 10:00 A.M. with the following attendance:

American Face Brick Association: F. W. Butterworth, F. T. Owens, Wm. C. Koch, R. D. T. Hollowell, Secretary.

Clay Products Association: Fred L. Dickey, Geo. C. D. Lenth, Secretary.

Common Brick Manufacturers' Association:. W. G. Bohnsack; Chas. A. Bowen, Asst. Secretary, Wm. Carver, Architect.

Eastern Clay Products Association: H. T. Shelley, Secretary.

Hollow Building Tile Association: J. T. Howington, J. L. Murphy, J. J. Amos, J. S. Sleeper, Secretary.

National Paving Brick Manufacturers' Association: O. W. Renkert, W. P. Whitney, Charles Francis, W. P. Blair, Edward E. Duff, Secretary.

National Terra Cotta Society: H. J. Lucas, B. S. Radcliffe, F. B. Ortman.

Refractories Manufacturers' Association: Arthur P. Taylor, M. C. Booze, Frederic W. Donohoe, Secretary.

Mr. Hollowell called the meeting to order by stating that at Washington it seemed to be the consensus of opinion that there were great possibilities for coöperative research on common problems of the various clay products industries and that this meeting was called for the purpose of discussing organization.

Thereupon F. W. Butterworth was elected temporary Chairman and J. S. Sleeper temporary Secretary. The roll call disclosed the fact that of the ten associations to whom invitations had been extended, eight were represented.

Ross C. Purdy, Secretary of the AMERICAN CERAMIC SOCIETY offered a proposal from that organization for a close affiliation. On account of the length of his statement it is not included in this report. R. D. Landrum, President of the SOCIETY, also spoke briefly on the subject.

The meeting then went into executive session whereupon it was decided that the organization should first be perfected and that the question of ways, means and affiliations should be taken up later.

Mr. Owens moved that the name of the organization be the CLAY PRODUCTS INSTITUTE. This was seconded by Mr. Donohoe and carried.

On motion of Mr. Howington, seconded by Mr. Dickey and carried, it was decided that details pertaining to the By-Laws and Constitution be referred to a Committee composed of one member and the Secretary from each Association.

Chairman Butterworth then introduced Mr. P. H. Bates of the Bureau of Standards who outlined briefly the organization of the Bureau and the facilities it offered. He described the confusion and duplication that occurred when it was necessary for the Bureau to deal with the individual manufacturer rather than the industry as a whole. He spoke very highly of the proposed Institute stating that it would offer a single point of contact which would enable the Bureau to serve the clay products industries much more efficiently than it has in the past. He stated further that he thought the organization should be on broad lines so that it could handle not only research work but promotion and service work as well.

That the delegates might carry back to their associations a tentative statement of the object of the proposed organization the Chairman appointed a special committee to formulate such a statement which they did as follows:

The following paragraphs are intended to reflect the sentiments of the organization meeting of the CLAY PRODUCTS INSTITUTE:

They are to be submitted to the general Organization Committee, consisting of the Secretary and an Executive Member of each of the coöperating associations.

It is understood that the Organization Committee is not and cannot be in any way bound to specific action in regard to any of these declarations of principles.

The purposes of the CLAY PRODUCTS INSTITUTE shall be:

(1) The development of the clay products industry.

(2) To provide means for coöperative research work for

- (*a*) the improvement of its products,
- (*b*) the reduction of manufacturing costs,
- (*c*) to insure better service and consequent public economies.

(3) To afford a point of contact with Government Bureaus and such institutions and organizations as may be found to be helpful in carrying out the purposes as herein set forth.

Upon motion made by Mr. Dickey, seconded by Mr. Renkert and duly carried the report was adopted.

Mr. Dickey then moved that the temporary organization be held intact until a meeting for permanent organization be held and that such a meeting be held in Chicago at the Hotel LaSalle at 10:00 A.M., October 17, 1924. This was seconded by Mr. Howington and carried.

Upon motion made by Mr. Donohoe, seconded by Mr. Lenth and carried it was decided that the Organization Committee meet in Chicago on October 16th at 10:00 A.M. to prepare their report for the meeting on the 17th.

It was then moved by Mr. Dickey that the preliminary expenses should not exceed $500 per association and that following the October meeting a full schedule of the ac-

tivities and annual expenses would be submitted to each association participating. This was seconded by Mr. Koch and carried.

Mr. Howington moved that Mr. Butterworth act Ex-officio as chairman of the Organization Committee. This was seconded by Mr. Dickey and carried.

The possibilities of accomplishment were then briefly and informally discussed by a spokesman from each association following which the meeting adjourned.

J. S. SLEEPER, *Temporary Secretary.*

RESOLUTION FOR CERAMIC INSTITUTE

At a meeting of the Executive Committee of the New Jersey Clay Workers Association and Eastern Section of the AMERICAN CERAMIC SOCIETY held at the Trenton Country Club, Trenton, N. J., on June 20, 1924, the Secretary was instructed to forward copies of a resolution, as follows, to the Secretary and members of the Board of Trustees of the AMERICAN CERAMIC SOCIETY:

RESOLVED: It is the concensus of opinion of the members of the Executive Committee of the New Jersey Clay Workers Association and Eastern Section of the AMERICAN CERAMIC SOCIETY that the functions of the proposed Ceramic Institute can be carried out by the AMERICAN CERAMIC SOCIETY as at present constituted, through its Industrial Divisions and Local Sections.

SOCIETY OF GLASS TECHNOLOGY

During the last week of May a party of some 20 members of the Chambre Syndicale des Maîtres de Verreries de France paid a visit to England at the invitation of the Society of Glass Technology, thus returning a visit paid last year to France by members of the British Society.

The program included visits to glass works, to Harrow School, to the British Empire Exhibition at Wembley and to the Department of Glass Technology of the University of Sheffield. On Tuesday evening the delegates were entertained to dinner in London on the occasion of the annual dinner of the Society. The other guests were Dr. E. F. Armstrong, F.R.S. (President of the Society of Chemical Industry), Judge F. E. Bradley, LL.D. (Master of the Glaziers Company), J. Holland, Esq. (President of the Ceramic Society), and Dr. C. Baring Horwood (Master of the Glass Sellers Company).

During the week two meetings were held. The first was held in University College London, on Tuesday, May 27, and was a joint meeting with the British Society of Master Glass Painters. The President of the latter Society, the Earl of Crawford and Balcarres, was in the chair and was supported by Col. S. C. Halse, C.M.G. President of the Society of Glass Technology. Three papers were presented.

1. Dr. Ethel Mellor, in a paper entitled "The Decay of Window Glass from the Point of View of Lichenous Growths" gave an interesting account of the acceleration of the decay of glass in ancient stained glass windows by the growth of lichens which made their habitat on the glass. Numerous specimens of these were exhibited and the paper was illustrated by a number of slides.

2. Mr. Noël Heaton, B.Sc., contributed a paper on "The Decay of Mediaeval Stained Glass." He referred to the wide variations in resistance to decay found in mediaeval stained glass. He considered that this was to be attributed mainly to variations in the composition and physical structure of the glass used.

Window glass was introduced by the Romans, who arrived at a very sound composition, and their glass was remarkably durable. Analyses of glass of different periods revealed the differences in composition which resulted from a departure from the Roman tradition in mediaeval times. The resulting loss of durability was illustrated by a series of slides. The lowest ebb was reached about the end of the 14th century, one of the most notable examples being the glass of York Minster, which was in such an extreme state of decay as to require the most careful supervision in its repair.

In the process of decay two causes operated simultaneously; surface weathering due to atmospheric action, and well defined pitting due to the structure of the glass. The variations found in stained glass of the same period was attributed mainly to primitive methods of manufacture, with certain affecting causes. It was characteristic of mediaeval glass that the painted portions resisted decay better than the glass itself, which might be attributed to the lead silicate used uniting with the glass to form a more durable composition. The reverse was the case in later times, the enamel often perishing while the glass remained sound.

3. The last paper was "The Weathering and Decay of Glass" by Prof. W. E. S. Turner, D.Sc. Ancient observers, attributed the decay of glass to various causes, some to the moon, others again to the sun. Even as recently as 1879, James Fowler in his well known treatise on this subject made a minute examination of the decay of glasses of different epochs without being able to come to any precise conclusion. But the nature of the corrosion of glass has been methodically studied by the physical chemist, and the principal causes were now fairly well known.

The chief agent of the action of the atmosphere was moisture. All glassware absorbed moisture to an extent dependent in the first place on its composition, but partly also on the manner in which it had been treated by the workman. Glasses with little stability were those which contained excessive proportions of alkaline oxides, whether of sodium or potassium. Glass of the type silica-soda-lime (such as window glass and ordinary sheet glass) which contained more than 18% of sodium oxide too readily decayed; at the same time the presence of at least 2% of potassium oxide permitted the total alkaline oxides to be increased to 20% without serious danger.

The components which increased the resistance to decay of ordinary glasses were silica, lime, alumina and magnesia. Boric oxide was also very beneficial in a proportion of less than 12%. The eventual hollowing out and the furrowing of glass in process of decay were associated with the mechanical treatment which it had received.

The second meeting was held in the Applied Science Department, Sheffield University, on Thursday, May 29. Col. S. C. Halse, C.M.G. in the chair. The following three papers were presented:

1. "Alumino-Silica Minerals in Fired Glass Pots," by W. J. Rees, B.Sc.Tech., F.I.C.

N. L. Bowen and J. W. Greig of the Geophysical Laboratory, Washington, U. S. A., had recently revised the investigations previously made on the binary system Al_2O_3-SiO_2. They showed that there was only one compound of alumina and silica which was stable at high temperatures. This compound had a composition $3Al_2O_3.2SiO_2$, and chemically was quite distinct from sillimanite (Al_2O_3-SiO_2), although its optical and crystallographic characteristics were almost the same. The crystals of so called sillimanite which were found in the different kinds of fired refractory material and in the ceramic articles were always crystals of the compound $3Al_2O_3.2SiO_2$. Researches made by the author (Mr. Rees) during the firing of pots, and blocks from glass works, as well as during their use at high temperature, corroborated the results obtained by Bowen and Greig. The proportion of $3Al_2O_3.2SiO_2$ which were found in refractory materials after firing depended upon the composition of the material, upon the degree and duration of the heating, and upon contact with, or absorption of, siliceous matter such as glass.

2. "The Effect of Various Constituents on the Viscosity of Glass." by S. English, M.Sc.

To the glass manufacturer, the viscosity of molten glass is perhaps the most important of its properties, as it is the viscosity and the way in which it varies with alteration of temperature that determine whether a glass can be satisfactorily melted, planed and worked. Though the importance of this property has been realized, the practical difficulties of measuring the viscosity at temperatures up to 1400 has prevented the subject being systematically investigated. Results have been published of only a few determinations, and the data provided do not always appear to be consistent, though it is not easy to test this point as the composition of the glasses are not generally given.

Of the various methods which have been used or suggested for the determination of the viscosity of liquids the "rotation" method seems to be the most useful for glass as it can be used over such a large range of viscosity. In applying this method, the glass was melted from cullet in a standard sized cylindrical crucible, and an iridioplatinum sheath secured on the end of a porcelain rod was rotated on its own axis in the center of the crucible of glass. The time required for the iridioplatinum sheath to complete one rotation under different loads at various temperatures was determined, and the viscosity was given as a function of the product of the net effective pull and the time of rotation. The apparatus was calibrated by using syrup, the viscosity of which had been previously determined.

The glasses used consisted of a series soda-lime-silicates obtained by a molecular substituting lime for sodium oxide in a simple sodium silicate, and a similar series in which the sodium oxide was substituted by magnesia.

The curves for the viscosities from about 750° to 1400°C show the way in which the viscosity is increased by substitution, and decreased by a rise of temperature.

3. "The Thermal Endurance of Glass. Part I." by V. H. Stott, M.Sc.

In spite of its practical importance the theory of the thermal endurance of isotropic bodies had been somewhat neglected. A theory was submitted, which however owing to the complexity of the phenomena involved, was necessarily not entirely satisfactory. Actually it was possible to increase the thermal endurance of glass by a suitable thermal treatment, but a general method for effecting this could not be given. Another question of practical utility, which could not be determined in a general way, was that of finding the shapes of glassware which were most resistant to thermal shock in the limits imposed by usage. Here again, each case had to be specially considered. It seemed therefore that, from the point of view of thermal endurance, they could choose a glass which suited a given purpose according to its physical properties, but it was most difficult to determine the best process of manufacture for an actual article, or to arrive at a proper method of testing the value of the object made. It was therefore not desirable at present to fix any formal method of testing.

Part II. By V. H. Stott, M.Sc., and Edith Irvine, B.Sc.

Experiments were made which showed that rupture was generally due to local differences of temperature, rather than to the uniform shrinkage of large surfaces. Although this interpretation of the experiments showed that the conditions assumed in the first part of the paper were not strictly fulfilled, the effects of the different factors were not greatly changed, and the formula cited would give satisfactory comparative results. In particular, since rupture was almost instantaneous, the conductivity of glass could not have great importance.

The last meeting of the Society of Glass Technology for the session 1923–24 was held in Sheffield, on June 18th, the President, Col. S. C. Halse, C.M.G., in the chair. Two papers were presented.

(*a*) "Some Remarks on the Erection and Operation of Modern Pot Furnaces," by Percival Marson. In the absence of the author, this paper was read by Prof. W. E. S. Turner, D.Sc.

The author pointed out that the glass manufacturer, before constructing a pot furnace, which represented so heavy a capital expenditure, should have adequate plans prepared. A furnace builder who knew his business should be able to guarantee his furnace, but in any case it was desirable to have a technologist as intermediary in order that suitable specifications might be laid down and adhered to. Among other things the builder should study the nature of the ground upon which the furnace was to be erected and he should construct an adequate foundation, providing also any necessary drainage and protection of the flues from ingress of water. The provision of suitable flue dampers with some form of indicator allowed of a more accurate regulation of the furnace during working. A small hole in the furnace above one of the pots served to give an indication, by observation of the issuing flame, of the state of combustion, so that correct conditions could thereby be attained. For a "full crystal" glass a furnace temperature of 1306° was sufficient and nothing was gained by exceeding this, but for soda-lime glass a temperature of 1400° could be maintained with advantage. It was claimed that for the crystal glass a circular pot was better than an oval or egg-shaped one, since it was less likely to cause cords in the glass.

(*b*) "Note on an Unusual Type of Recuperative Tank Furnace," by F. W. Hodkin, B.Sc. and Prof. W. E. S. Turner, D.Sc. This paper was presented by Mr. Hodkin who gave an account of observations made upon a recuperative tank furnace in operation at the Belinda Works of Messrs. Law & Shaw, Ltd., Leeds. The observations were made as the result of an invitation extended by Mr. J. S. Shaw to Prof. Turner to inspect the furnace.

The main feature of interest was the method of recuperation of the secondary air. This air entered by arched passages situated beneath the bottom of the tank and above similar passages conveying the exit gases to the chimney flue. It then passed by means of vertical channels in the working end of the furnace to a space between an upper and a lower crown. After traversing the space between the crowns, the air entered the furnace through a series of ports which were placed so as to have the gas ports between them.

Producer gas was admitted, without preheating, through a gas-chamber connected with ports or burners opening into the melting end of the furnace. The flames traversed the whole length of the furnace, the products of combustion escaping through vertical downtakes in the working end to the flues beneath the tank.

The batch was charged through an opening at the side of the furnace and one big advantage claimed for the method of construction was that it permitted of working operations being conducted along the walls, not only of the working end, but also of the melting end, by the use in the latter of syphons.

The tank had a double bridge. In other words, the bridge had three walls separated by cavities through which steam was blown for cooling purposes.

With gas at 700°C and air at 720°C, the temperature of the glass in the melting end was 1460°C. The production of glass from the tank, which was not being worked at full capacity, averaged 60 tons per week for a consumption of about 60 tons of coal on the producers. This glass was worked by three machines with feeders situated in the working end of the furnace, and by hands from four boots in the melting end. The designers anticipated a production of more than 120 tons of glass per week when working fully.

The President intimated that a party of members of the Society was visiting Belgium from July 7th to 12th.

REPORT ON SHORTAGE OF COAL COMMITTEE

New York, July 6.—Danger of coal famine will be eliminated, industry stabilized, railroads relieved and the consumer's coal bill ultimately cut by seasonal storage of coal, it is asserted in the report of the Storage of Coal Committee of the American Engineering Council made public here today.

"The storage of coal," the report declares, "is essentially necessary as an aid to the solution of the national coal problem, and is an economic and practicable means of insuring an adequate supply of coal as needed."

"If each coal consumer will adopt the policy of annually purchasing coal on a uniform monthly delivery basis, there will result automatically sufficient seasonal storage to guarantee coal to the consumer, as needed. Furthermore, this policy will bring about a uniform demand for coal whereby the coal producer and carrier may establish uniform and standard production and shipment schedules."

"It will also remove the evils of intermittent operation of coal mines, frequent panicky market conditions, and coal shortages due to inability of the carriers to meet peak demands."

Seasonal storage of coal by consumers, the committee finds, is an economic and practical means of insuring an adequate supply and satisfactory quality of coal when needed. "The irregularity in coal production," the report continues, "is largely due to seasonal demand. Since more coal is consumed in the late fall and in the winter than at other periods, coal producers and carriers each year are confronted alternately with a feast and a famine—with an inordinate demand for coal and transportation followed by a period of no demand. This seasonal demand is responsible for forty-seven per cent of the idle time of the coal industry."

"Seasonal demand also contributes to another very disturbing element, namely, the over-development of mine capacity through opening too many mines. Coal production capacity is now twice as large as the consumption capacity. The two factors—intermittent or seasonal operation and over-development—are in a very large measure responsible for the ills of the coal industry."

The report, given out by Ex-Governor James Hartness of Vermont, president of the American Engineering Council, comprises about 110,000 words. It was prepared by a main Committee of the Council, headed by W. L. Abbott of Chicago, working with the Department of Commerce, the U. S. Coal Commission, and federal, state and municipal agencies as well as private enterprise.

Sixty-seven sub-committees, functioning in every important industrial center in the United States, and comprising 400 individual engineers, constituted the field organization which carried on the nationwide survey for more than a year.

The report sets forth "a simple and practical remedy," saying that it is the coal consumer who must start the cycle that will bring about a stabilized industry.

"The amount of storage required to produce these corrective and constructive results," the Committee declares in summarizing its conclusions, "is small in terms of the per cent of annual consumption. For seasonal storage, from nine to ten per cent of the annual consumption is all that is required. If this amount is supplemented by additional reserve storage of no more than seven per cent, there will result an accumulation of some 83,000,000 tons of coal in storage by September 30 of each year. The practicability of this amount of storage with but slight additional outlay for equipment is indicated by the fact that in September, 1923, 56,000,000 tons were in storage."

"Equipment has been developed and may be secured to meet any storage situation or requirement. The cost of such equipment ranges from a few cents per ton of capacity up to $2.50 or $3.00 per ton of capacity."

"Storage of coal present no serious risk of loss from breakage, spontaneous combustion, or loss of heat value or firing qualities. All kinds of coal have been and may be successfully stored. The insignificant money loss due to the factors named above should not deter any one from storing coal. Application of the simple and inexpensive regulations and practices set forth in this report will provide all reasonable safeguards against such possible losses."

"The cost of storage per ton, including fixed charges on equipment, maintenance and operation expense and interest on investment in coal as well as taxes and insurance, in most instances does not exceed seventy-five cents per ton yearly. More generally it is around fifty cents per ton yearly. This cost is insignificant when distributed over annual consumption."

"Storing of coal may be easily financed. Banks will finance such an investment as readily as any other commercial undertaking."

"The transportation facilities of the United States are adequate normal and regular movement of coal. For short periods the railways can move coal at an abnormal rate, but this is both expensive and detrimental to shipment or other commodities and to normal freight movement."

"To increase transportation facilities to meet the peak demands resulting from the prevailing unsystematic practice in coal shipment would require an additional investment of some $12,000,000,000. Such an investment is not justified."

"The railroads have more to gain by storing coal than any other class of consumer. They should store their own coal on such a scale and at such times as to obviate the movement of company or non-revenue producing coal during the period when there is a heavy demand for the transportation of revenue producing freight. They should abandon, however, the uneconomic practice of using freight cars for storing coal and thereby withholding railroad equipment from other uses."

"In general, storage should take place at the point of use, to accomplish the most in relieving transportation and safeguarding supply. However, under some circumstances, storage-in-transit or at an intermediate point is advisable."

"In general, storage at mines is not recommended, but there should be sufficient mine storage facilities and capacity to overcome ordinary operating delays, such as belated arrival of cars, temporary break down or idleness of mining equipment and the like. Such provisions would materially increase the producing hours of mines and miners."

"Cars should be assigned to mines upon the basis of coal actually sold and not upon rated capacity of production. This measure would be a wholesome deterrent to over-development of coal producing facilities."

"While this study refers primarily to industrial consumers of bituminous coal, yet householders have also a direct responsibility. Indeed the householder is in a position to aid with the least cost, because no special equipment for storing and reclaiming is required and his individual investment in coal is relatively small. Householders use approximately 50,000,000 tons of bituminous coal annually, which, if placed in their bins by the end of September of each year would materially contribute to the solution of the coal problem."

"Federal, state, city and other civic divisions of the body politic are not meeting their responsibility in relation to the seasonal storage of coal. They are as derelict in regard to seasonal storage as are other users and frequently add to a confused situation by securing priority orders. Public officials should take the lead, by precept and by example, in furthering the storage of coal."

"Contracts for coal should be observed with fidelity. The evil practice of indiscriminate breaking of coal contracts has seriously injured the American coal industry

with reference alike to production, transportation and consumption. Contracts for coal should be observed with the same good faith as universally prevails in regard to other forms of commercial contracts."

"Confirmation of the practicability of coal storage is afforded by the anthracite coal industry. This industry is far more stable than the bituminous, because producers, carriers and consumers of anthracite coal for a number of years have alike encouraged and practiced storage."

The committee recommends that all coal consumers purchase their coal on an annual contract for yearly requirements with a provision that the coal be delivered monthly in equal allotments. It urges that consumers provide necessary storage facilities to meet the terms of such contract.

"These recommendations," the report points out, "are based upon the finding that the purchase of coal upon a uniform monthly delivery basis will result in a condition whereby coal mines may inaugurate and maintain a regular production schedule; carriers may plan definitely as regards both schedules and equipment for a uniform movement of coal; stocks of coal automatically will accumulate during the months from April to September inclusive in sufficient amount to meet the extra consumption during the winter months; a reduction in the price of coal will be made possible by more regular schedules of production and transportation and by elimination of peak demands in the winter months when the costs of both production and transportation are the highest."

The committee reiterates, says the statement of findings given out by Ex-Governor Hartness, that the coal consumers through seasonally storing coal can and should initiate this vitally necessary cycle of changes.

The personnel of the committee of the American Engineering Council which conducted the investigation follows:

W. L. Abbott, chief operating engineer of the Commonwealth Edison Company of Chicago, chairman; H. Foster Bain, Director of the Bureau of Mines, Washington; William Hutton Blauvelt, consulting engineer, New York City; W. H. Hoyt, chief engineer of Duluth, Missabo and Northern Railway Company, Duluth, Minn.; William J. Jenkins, vice-president and general manager of the Consolidated Coal Company, of St. Louis; David Moffat Myers, consulting engineer, New York City; Prof. S. W. Parr, University of Illinois, Urbana; Dean Perley F. Walker, University of Kansas, Lawrence; Roy V. Wright, editor of the *Railway Age Gazette*, New York; Edgar S. Nethercut, secretary of the Western Society of Engineers, Chicago; O. P. Hood, U. S. Bureau of Mines, Washington.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
American Foundrymen's Association	Oct., 1924	
American Gas Association, Inc.	Oct., 1924	
British Assn. for the Advancement of Science	August 6–13, 1924	Toronto, Canada
Chemical Equipment Assn.	Sept., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Paving Brick Assn.	Dec., 1924	
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)

ANNOUNCEMENT

1924 SUMMER MEETING

AMERICAN CERAMIC SOCIETY

October 6 and 7
Los Angeles, California
Biltmore Hotel

Morning and afternoon sessions for reading of papers and discussions

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Dinner Meeting Tuesday Evening

Inspection of Plants in the Vicinity

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For details write Fred B. Ortman, General Chairman Summer Meeting, Tropico Potteries, Inc., Glendale, Calif., or Ross C. Purdy, General Secretary, Lord Hall, O. S. U., Columbus, Ohio

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Vol. 3 | September, 1924 | No. 9

EDITORIAL

THIRTY YEARS OF COLLEGIATE TRAINING IN CERAMIC ENGINEERING

It was in September, 1894, thirty years ago, that Professor Edward Orton, Jr. first sat before a class in "ceramic engineering." This was a unique event; the beginning of a system which in time was to be valued by the ceramic plant owners, although then little appreciated. That young professor had no way of visioning what would be accomplished in thirty years; sufficient was the faith in the opportunities for which he and his "boys" were preparing. Their faith has been justified.

When the first class was called to order, Professor Orton had already contributed largely to the advance which has since been made in ceramic technology. A cursory review of the thirty years which have followed will encourage and enthuse for the larger accomplishments yet to be realized. Such a review will be worth making, and as surely as it is made so surely will no small debt of gratitude be felt and no few words of appreciation be spoken of the foresightedness and ability to accomplish which made possible the meeting of that first class in ceramic engineering in 1894.

Ten collegiate institutions of learning in this country, and one in Canada, now have similar courses in ceramic engineering. Georgia, Penn State and North Carolina have established courses within the past year. At all

of these institutions the students are made acquainted with those fundamental sciences which are basic in ceramic engineering. They are trained in the use of facts in the solving of ceramic problems. The pupils learn the methods whereby these fundamental data are obtained, where they are recorded, and the engineering use which they serve.

Of greatest value is the training received by the students in the use of data. The fundamental facts may be only hazily remembered, but the methods of using them in the solving of problems and in the constructing of things according to the fundamental laws applying, is permanently acquired and is the real essence of the training received. Facts regarding gases, combustion, drafts, flue systems, etc., are essential, but of more importance is ability to design efficient kilns and furnaces. The knowing how to construct a workable unit and make a serviceable product is more essential than the remembering of detailed fundamental facts. The ability to use fundamental data and laws requires only the training of common sense and judgment. This same common sense and judgment is possessed by many persons employed in ceramics without the opportunity of collegiate training; it is the same common sense which promotes from the bench to plant managership.

Professor Orton used to tell his classes in those early years that a collegiate training was no sure short cut to industrial leadership, nor were the experiences had in the class room a substitute for factory experience. The truth of this is more apparent today than it was thirty years ago. Collegiate training in the solving of construction and fabricating problems in ceramics is merely the acquainting of the students with the sources and records of fundamental facts and the means of using them. Judgment in the selection and use of facts in the solving of problems can come only through experience.

Collegiate training cannot take the place of native common sense. The sad record of graduates of universities gives emphasis to the importance of native common sense.

What the ceramic manufacturers lacked thirty years ago, and what they lack to a very large extent today, is a familiarity with the fundamental principles underlying the chemistry and engineering in manufacturing, and particularly the lack of knowledge of how to use these fundamentals.

In contrast to the situation thirty years ago, when the graduates of the collegiate ceramic department could find employment only at a day laborer's wage and did not have the confidence of the employer, ceramic plant owners are now seeking the services of these graduates. It is the testimony of the directors of the several ceramic departments of the universities that their demand for men is in excess of the supply. The service which the men trained in the colleges can render is today more appreciated, and yet there has been no adequate demonstration by these graduates of

the sort of service which will be possible when we shall have learned better how to use the fundamental sciences in the solving of our plant problems.

In comparison with the graduates of other technical and engineering courses, the graduates of the ceramic departments have done well. Maximum and minimum wages earned compare favorably with those of the others, as does the percentage of graduates who finally acquire financial substance and managerial or executive positions. But there is no satisfaction which can rightfully be had in this situation. It merely indicates that such as has been accomplished through collegiate training in ceramics has been worth while. There is a very serious need of taking stock of the situation. There is a need for a frank and studious consideration of how the colleges should prepare their pupils for industrial service. The number of schools giving ceramic courses is multiplying rapidly. Other large institutions are considering establishing ceramic departments. In justice to the pupils who are going to apply to these schools for the training, and to the tax payer who is to meet the expenses and to the ceramic manufacturers who are to employ their graduates, very careful thought should be given to the best and most productive methods of training these pupils for service.

The method of training outlined by Professor Orton thirty years ago is still in use without any great amount of change. The schools are still taking the students through the same steps. They are approaching the problems of compounding of ceramic mixtures from the raw material standpoint rather than from the properties which the manufactured ware should possess. Fabricated wares must have more than appearance; they must possess very definite properties in order to withstand specific destructive influences in their use. Electrical porcelains must have shape, strength and other properties to withstand the stresses and strains, not only mechanical and electrical, but also climatic. Nearly every ceramic ware has its own peculiar destructive agencies to withstand in use. An understanding of the conditions of use of the ceramic products is just as essential as an understanding of the manufacturing processes, and certainly just as essential as an understanding of the composition peculiar in each case.

A review of the problems being undertaken by the Federal Bureaus and by the several industrial laboratories reveals that the major portion of them deal directly with the use of the products and means of so compounding and constructing the products as to withstand the destructive influences in use. These are just as much within the sphere of ceramic engineering as is the construction of plants and the production of wares. The need of these sorts of studies is just being revealed, and with the realization of this need, there surely will be a remodeling of the courses of studies in the university ceramic departments.

As the number of schools increases with the demand for more trained men, and with the enlarging of the scope and use of the Federal Bureaus, the Mellon Institute and other research agencies giving special attention to ceramics, there is a growing appreciation on the part of the plant owners of this sort of service. It is a matter of record that notwithstanding the very large amount of research work and routine testing done by the Fellows of the Refractories Manufacturers Association at Mellon Institute, there has been an increasing number of technical men employed by the refractories manufacturers, not alone in the plants, but also in the sales forces. Increase in employment of technically trained men naturally follows the proving of the value of such employment.

The organizing of plant owners through their respective trade associations in an Institute for the purpose of collaborating in research is the latest and most interesting result of the beginnings which were made thirty years ago in that first class in ceramic engineering conducted by Professor Edward Orton, Jr. Closed doors, hidden notebooks and sealed lips were almost universal thirty years ago; and in contrast, the manufacturers today visit each other's plants, compare notes and discuss freely their technical problems. Rather than guarding jealously their information so as to retain what they suppose to be a vital reason for their employment, the "experts" today are conferring one with another and exchanging information. They find that there is altogether too little knowledge of the fundamentals involved and too little knowledge had by any one of the best methods of applying fundamentals, and that the ability which distinguishes one man from another lies not so much in the knowledge possessed as in common sense in the use of knowledge.

Schools in ceramics will multiply, and the number of research laboratories, both private and semi-public and State operated will increase. We have just entered upon the era of organized collaboration among manufacturers.

Because Ohio State University was the place where collegiate training was first inaugurated, the officers at this University have asked ceramic manufacturers and the several ceramic schools to join with them in the celebration of the thirtieth anniversary of the beginnings of collegiate training in ceramics. The AMERICAN CERAMIC SOCIETY is going to coöperate with the University by meeting on the campus during the week of this anniversary celebration. It is fitting that we review analytically the progress made, but it is far more fitting that we analyze the need of the day and the need of tomorrow in the matter of collegiate training of men, not only for the factories, but also for the laboratories.

The time of this celebration will be the week of February 16 to 21, 1925 inclusive, and the place will be Ohio State University, Columbus, Ohio.

PAPERS AND DISCUSSIONS

MINING OF INDIANA CLAY FOR TERRA COTTA[1]

By L. Behrendt

In the manufacture of terra cotta the supply and uniformity of the raw material are of prime importance. It is needless to say that clay is the chief raw material and to obtain a uniform and suitable supply is of prime importance to the terra cotta manufacturer. Terra cotta is fired to temperatures varying from cone 01, to 7 or 8, depending upon the available clays. The experience of the writer has been limited to the Central District and all statements made in this paper refer only to the conditions prevailing in that section. The terra cotta there is made from a clay which contains a sufficient fluxing material to give a very hard and strong body at cone 01, or 1. This clay is a coal-measure clay. It is obtained from the mining sections in and around Clay County, Indiana.

In the Indiana clay and coal field the uppermost stratum is a yellowish clay, covered with a thin layer of humus. This stratum varies from five to twelve feet in thickness. Immediately below this is a hard shale of a bluish color more uniform in thickness and of an average depth of about twelve feet. This shale rests on a vein of coal varying from two and a half to four feet in thickness. This is properly the third stratum, although, in some places, there is a seam of hard pan or conglomerate between the shale and the coal. This is of some importance as the presence of this hard pan is the source of much trouble and worry to the steam-shovel operator. On the market this coal is known as upper vein block coal. It is a good kiln coal and the screenings are used for boiler purposes. The fourth stratum which is immediately below the coal is a buff burning clay, which is used for manufacturing terra cotta. This stratum due to the conditions prevailing at the time it was deposited, varies in composition. The thickness of the clay in this stratum suitable for terra cotta purposes varies from eight to thirty inches. Beneath the terra cotta clay is found a layer of so-called kidney stones, imbedded in the clay, which varies from three to twelve inches. The lower part of this stratum is a highly siliceous material. The layer of terra cotta clay varies in thickness within small areas throughout the district. The seventh stratum is a blue shale which varies from fifteen to thirty feet in thickness, which might be used for making brick and other dark colored building material. The eighth stratum is what is called the lower vein block coal and varies from two and a half to three feet in thickness. Beneath this coal is found another stratum of clay which at one time was used exclusively by the terra cotta manufacturers.

Two distinct methods of operation are used in the mining of Indiana

[1] Presented by Mr. Thurlimann at the Atlantic City Meeting, Feb., 1924 (Terra Cotta Division).

clay and block coal. First, shaft mining and second, open mining, by stripping the overburden. Shaft mining is far more difficult in the block coal mines of Indiana because as a general rule the overburden does not make a sufficiently strong roof to afford safety in working without very heavy timbering. On the other hand, since the overburden is not very deep, stripping operations are far more satisfactory and economical and are in general use in that region.

The stripping is accomplished by means of a steam-shovel usually of large size so that the bucket will pick up about three and a half cubic yards of the overburden at one time. This is then dropped on the ground where the coal and clay have been removed. The loading of the coal and clay is done by a steam-shovel which is capable of loading from twenty to thirty cars of coal or clay per day of eight hours, but never actually reaches that capacity because the coal and clay cannot be moved away fast enough. In the mining of the clay great care is necessary on the part of the steam-shovel operator to get all the clay without picking up any of the clay iron balls or kidney stones.

Coal mining operations have been carried on in this district for about sixty years. The thicker veins were naturally the first to be worked. The best clays were found beneath the thick coal measures. At the present time there are only a few of the first and second coal measures being operated.

The quality of clay in this district varies so much that it is necessary for the laboratories to make tests on most all cars that are received at the plant. The so-called rubber clay is objectionable because it is hard to mold and it cracks badly in drying. The highly siliceous clays cause cooling cracks. Some of the clays have a high sulphur content, which is present either as pyrites or in the form of soluble sulphates.

Some of these clays, particularly the lower vein burn to a salmon color. The difficulties encountered by the presence of pyrites are blistering and greenish black spots on the enameled surface of the ware. When present as soluble sulphates, the salts are brought to the surface in drying and the slips and enamels do not adhere to the surface of the ware and the result is peeling.

Midland Terra Cotta Co.,
Chicago, Illinois

WHAT IS THE EFFECT OF SELENIUM DECOLORIZER ON THE TANK BLOCKS[1]

By H. L. Dixon

Mr. Dixon: All those who think the use of selenium decolorizer is injurious to the tank blocks are as yet unable to tell just what causes it.

[1] Presented before the Glass Division, Atlantic City Meeting, Feb., 1924.

In a number of cases the blocks in the furnace are damaged and worn away much more rapidly than they were in the same furnaces when they use manganese as a decolorizer. It is a strange thing too that in many instances the front walls of the melting chamber and the bridge wall are worn away more rapidly than the filling end next to the dog house. This is almost a reversal of the conditions existing before.

If a tank is working properly the glass near the bridge has become almost perfectly plain. The fusing and clarifying of the materials has occurred before it reaches that point so that next to the bridge or on the front end of the melting chamber there is a body of glass that is very transparent. We know the heat rays penetrate glass as does light, in proportion to its transparency. Naturally, therefore, without any color in the selenium glass and being more transparent than when manganese was used, some think that the intense heat penetrating the glass to a greater depth is the cause of more rapid erosion.

There is another theory. As furnace builders we get orders for furnaces of capacities from 12 to 75 tons of glass a day. We find that in nearly every case, after operating a year or little more, they have exceeded the rated capacity of the furnace. That has resulted naturally in the last few years from the use of improved feeders and automatic machines. Their calculations of capacity were based upon what they were able to accomplish with the unimproved machines. The productiveness of these machines have increased 25 to 30% since the furnace and the machines were installed. How do they meet that condition? They must increase the melting. They must run the furnace hotter. Consequently they have gotten into the habit of running their temperatures very much higher than previously.

These are a few conclusions reached not only from my own observations but also from the discussion of others who have not technical knowledge of the subject but who are simply up against the practical proposition almost every day. If there is any theory, any scientific solution of this, we should like to know it.

Dr. Shively: In recent years, unquestionably the tank builder has improved the efficiency of his tanks. Today it is nothing uncommon to find an actual temperature of 2800°; 2750° seems to be the average. I know of a number of tanks that never run less than 2650°. This high temperature has its influence on the tank block. I know of one particular case where a tank was in operation for 11 weeks at a temperature of 2750°. Mr. Dixon rebuilt this tank from the same blocks. On the advice of the technical men it was run at 2650° for the next fire and lasted 12 months. The temperature condition has a great deal to do with the blocks wearing away.

I know of furnaces in operation that are pulling as much as a ton of glass

on 7 square feet and in some cases they are pulling more than that. The old tank rating was a ton of glass to 12 square feet.

Another thing that has an influence on selenium glass is that today we are getting soda ash that analyzes about 99.6% sodium carbonate. It is a granular ash. It is my belief that polymerization losses in this granular ash are practically nothing. You cannot find any loss by an analysis of ash which is carefully put into the batch. The Lime Association has been working to supply burned lime having ignition loss of around 2%. This means that you are now getting more flux into your glass.

There is a tendency to increase the soda content in order to pull more glass. In machine operation they are pulling the tank six days in a week and usually pulling it hard. In the old hand operation, unless they were working three shifts, the tank stood still for 5 or 6 hours during the day, and when it was started up again the direction of the channel of the glass was changed. Erosion has a great deal to do with wearing the blocks away.

Mr. Dixon has advanced a theory in regard to heat and light transmission. A piece of molten green glass without any decolorizer in it is just as transparent as a piece of selenium glass. Manganese glass, of course, is not transparent but the green glass is. In the old days they considered that the green glass tank would last longer than a manganese tank.

On the other hand, I hear a great deal of complaint regarding manganese pots. They are using manganese pots right along.

The glass manufacturer is anxious to increase his production. He goes to the block manufacturer because of shorter time life. Selenium is the only new thing introduced hence they pass the buck to selenium. They do not consider that in using selenium the resulting saving is approximately a dollar a ton on the glass melted. In a 25-ton tank in 8 months, enough will be saved over the cost of using manganese to rebuild that tank.

The results being obtained must be considered. The tank glass today is better than the pot glass ten years ago. A lot of the contention in regard to selenium being hard on tanks can be attributed to other sources.

Dr. Silverman: I have had no experience with the effect of selenium on tanks but I have made selenium ruby glasses in pots. We use from 8 ounces to a pound and a half of selenium per hundred of sand. The pots have lasted anywhere from 22 to 40 weeks. In some cases the pots lasted 50 weeks continuously on selenium ruby. There was no excessive corrosion. So far as that experience is concerned, it would hardly seem to imply that the selenium is responsible for very serious corrosion.

Mr. Payne: Were these covered pots?

Dr. Silverman: Yes.

Mr. Dixon: In tanks making colored glasses such as blue, amber and green glass, it is well known that they will last longer than any tanks making flint glass. I do not believe that the fluxes in the flint glass are any

more detrimental to the blocks than the fluxes used in the green, amber and blue glass. Practically the only difference is in the color and the transparency. The tanks making that kind of glass last much longer than the others.

I did not say I thought there was anything in the selenium that would injure the block. I said it was probably due to the heat transmission because of the transparency of the glass which is more transparent than the glass made with manganese. In regard to our experience in using the same sort of lime batch, it used to make our tank blocks show much less pitting after we added selenium to the same fundamental batch.

Dr. Littleton: I do not have enough information to argue the heat transmission of molten glass. We do know that there is not more than 10% of the visible radiation at those temperatures. The rest of it is non-visible radiation, and while a glass may be much more transparent to that 10%, it can easily be much more opaque to the rest of it. We have glasses which are perfectly opaque to the visible and yet transmit, in a solid condition, a very high percentage of the infra red. Compared to some of the transparent glasses, the reverse is true. There is some evidence which indicates that glass is more transparent to the infra red in the molten condition than it is in the solid condition, but it is mere circumstantial evidence. There is nothing positive to indicate it. It would be rather surprising, from a theoretical standpoint, if it were more transparent to the infra red in a molten condition than it is in the solid condition.

Dr. Shively: A manufacturer who is pulling 18 or 19 tons on a 12-ton tank with green glass machines advises me that they do not get the life of tanks they formerly got when pulling 12 tons. Some of these green glasses are so stiff in the bottom that they frequently have to insulate the neck, not particularly in this country but in England, in order to get the glass through.

The life of a tank could be increased if the manufacturer knew a little bit more about how to heat up his tank. The clay people ought to know this. They have been a little lax in not giving advice to the glass manufacturer in regard to bringing up his tank. With the tank full of glass the fires downstairs are lighted. When 500 or 600° is obtained the fires upstairs are lighted. I have seen tanks brought up in a week to 2550°. Every block in a week would be honeycombed; just cracked to pieces.

A case in point may be interesting. A certain factory operates large tanks with 8-inch blocks. Two years ago they were getting 19 months out of their tanks with selenium. He said about that time they introduced the double mold and increased the capacity of their tanks from 30 to 50 tons, and likewise increased the temperature 200°. They are now getting 12 months out of the same tank. I think that illustrates what heat and tonnage do to the life of tanks.

MR. ROSS: I believe that careful observation of the amount and kind of batch filled into tanks and the temperatures of operation will lead to considerable information concerning the properties of tank blocks.

MR. FLINT: How can we make any more observations than we do with a recording pyrometer on temperature and an absolute knowledge of the number of pounds of batch that go in, and checking with an optical pyrometer the heats at the various locations in the tank?

MR. PAYNE: In an amber tank, which we were heating up, the entire bridge wall was criss-crossed with large cracks almost large enough to put one's finger into. Probably there was hardly a space on that bridge wall that did not have one or more of those cracks across it. That tank lasted 33 months yet the bridge wall was absolutely full of cracks. It was our opinion that if the bridge walls cracked in that manner they would go out in a hurry. We have had tanks which did not have those cracks. Some of these lasted well and others went out even faster than those which started with the cracks. It seemed to make very little difference whether or not those cracks were present.

MR. FLINT: What is the idea of drilling a hole in the block when the blocks have a hard enough time as it is. The best thing to do if we want to see what is happening to the block is to build it out of glass.

We have a heating schedule from 11 to 12 days. Generally with a recording pyrometer, it is a straight line heating increment from room temperature up to 2500 or 2600° with the exception of a drop of 100° when we change from the burners inside to the port burners. That schedule was adopted to give uniform heating conditions. Many tank block men were shocked because it took less than 25 days to heat up a tank. My first reaction was, if the men who make tank blocks do not agree better as to how long it should take to heat up, how will the glass maker be able to decide. Some say you really ought to use only 12-inch blocks, that is 12 x 12 or 24 x 36. They burn so much easier. Another one will advise the use of 30 x 36 so as to have less joints. There does not seem to be any unanimity of opinion about such things. And they really are fundamental.

One tank block salesman will see a block he knows to be his competitor's and say, "Do you buy blocks like that with cracks all over them?" And another says, "Yes, they have a few cracks but it does not amount to much." How can we get blocks that are uniformly well manufactured?

Very recently some blocks were delivered to one of our factories in Zanesville. They were odd-shaped blocks, the back end of a flow spout. The cross section of them looked like a U. They had sat in the middle of the freight car and just the jolting of that freight car was sufficient to cause the sides of that U to drop off. It left the imprint of the man's finger marks where he had to put it together. When that block is heated and cooled in use something is going to happen to it. All our blocks are not

like that, but enough of them are so that we wonder just to what extent some of the manufacturers are keeping after those little things. We realize that the man who worries and thinks about that the most is not putting that block together. The thing that makes that a success is the matter of superintendency and foremanship. Users of those blocks do not have a thing to do with this superintendency or foremanship but they have to take that block and take the consequences.

This subject has very recently been so strongly brought to attention. I looked up the records back to 1915. The tank life varied from 50 to 80 weeks in those days. Now it is about 20 weeks. By extrapolating, I calculate that in 1930, they will have no life at all. Our job is to stop this shortening of the life of the blocks before we get to 1930. A man I talked with recently stated that he does not use them any more. They did not last very well, so he began using ordinary 9-inch fire brick.

Mr. Finn: About 4 years ago in the Optical Glass Bureau we had a great many pot failures. Probably two pots out of three were in the habit of going through. Recently we changed our firing schedule making it slower in the beginning and finished at a higher temperature. This makes a longer schedule. The difference in the quality of the pots was so very marked that I am sure the manufacturer or the ultimate consumer of tank blocks would be justified in higher firing for his blocks.

A very significant point along that line is the use of these pots for the melting of a dense barium crown. Dense barium crown is regarded as probably the most corrosive glass made. I cannot say that it is more corrosive than a very dense lead (75% lead oxide) melt.

I was asked at what temperature I was going to run this barium crown. He said, "I would like to see some of the glass out of that pot. You will never get it out of the furnace." When we took it out of the furnace according to schedule the pot showed practically no signs of corrosion.

From a chemical point of view, lead oxide is one of the best solvents for refractory materials. I have had occasion to make but two or three melts of dense lead glass, but I may say that it took all the nerve I had to put a 75% lead oxide batch into a pot. I put it in, melted it, took it out, broke the pot, and the evidence of corrosion was very slight. We attribute that more to the firing treatment of the pot and the ultimate temperature of firing than to the quality of the materials. We have changed the pot batch quite a little bit to see what could be done. Within reasonable limits pots can be made of most anything if they are properly fired. I would like to urge that somebody making tank blocks try the effect of firing the pots up to that temperature at which they begin to lose their shape under their own weight. We hold them at these temperatures for about 8 hours and find we have a very wonderful pot.

MR. FLINT: We have very seriously talked with almost every tank block manufacturer about firing to high temperatures. Some of them say, "yes, it would be very interesting." Others will say, "No, it is absolutely unnecessary and useless time, labor and fuel to spend to do it." Others will say, "Some time we hope to do it." All of these men apparently have very thoroughly and seriously considered their own product. Part of the argument which they give against firing a block to 2600 or 2700° or even more, is that in the tanks they do not get to that heat. They say that not over 2 inches of the top rim which is above the surface of the glass and facing inside the tank gets to that heat.

MR. BROWNLEE: We fired 4 different batches of blocks at 2750°C. With these we built an experimental tank at the Owens Bottle Plant, and we ran a test for 6 weeks. The large tank had to be let out at the end of this 6 weeks hence naturally this experimental tank had to be cut off. We then enlarged the tank. We built it up with fire brick in three places exposing the fire brick to the glass. On letting the tank out we found that there was a slight wearing of the tank blocks, but there was no more wear shown on the tank block than there was on the fire brick. The fire brick was just flush with the tank wall. This experiment was not carried to completion. I think it is a very good idea firing the block higher. We are now firing our blocks to 2550°.

MR. FLINT: Did you use pyrometers or cones?

MR. BROWNLEE: Both.

I feel that the smaller the block is, the much easier to fire. The heat goes all the way through the block where it would not on a large block.

MR. MONTGOMERY: It seems as if one point has been missed in this tank block discussion, and that is the composition of the tank block. In optical glass manufacture, which includes everything from the ordinary soda-lime glass, which is not markedly corrosive, to the glasses of high barium and lead content referred to by Mr. Finn, we have to develop a pot which will suit each particular glass. The pot should mature and have the proper physical properties at the temperature at which the melt is to be made. A pot which will give satisfactory service at 2550 to 2600°F will seldom give equal service at 2650 to 2700°F. The composition of the pot will have to be changed to give the required properties at the higher temperature.

We melt some of our barium glasses at 2300 to 2350°F. It was necessary to develop a pot which would mature at this temperature or fire the pot to the temperature at which the necessary physical properties were developed. We fired the pots, used for this glass, at 2550°F.

If a very fluid glass like the densest barium glass is melted in an underfired or porous pot, it will run through the pot like water through a sponge. The glass will penetrate the pore space and seep out into the furnace. If

the same pot is fired to the point where it is dense, this filtration or seepage will be stopped. The point illustrated by this extreme case will apply to all pot making. The manufacturers of glass house refractories often do not realize the variety of conditions their products are called upon to meet. They do not suit their batch composition to these conditions. A commercial batch is expected to answer all purposes. This will never be satisfactory. The pot manufacturer must specialize more before much headway will be made.

Mr. Merritt: I have had no practical experience with these blocks, but I recently made thermal expansion tests on clays. The shape of the thermal expansion curve changes very definitely with the intensity of firing. The results obtained confirm Mr. Flint's statement that if a block or any clay material is to be used at a certain temperature it should be fired to that temperature and perhaps a little higher.

Mr. Flint: We have a couple of tanks, the blocks for which we would like to have fired to 2750°. Would it be possible to get such blocks?

Mr. Brownlee: I believe the clay would stand it. It would be more expensive, but I think in a smaller block it would be possible.

Mr. Flint: Could it be done commercially with the present type of kilns you are using?

Mr. Brownlee: Yes.

We fired the blocks that I mentioned in that experiment in a special small kiln. We would like to try it.

Mr. Flint: You will have the chance.

Mr. Fulton: I do not believe that the majority of block makers' equipment for firing tank blocks would stand any such temperature. In fact very few of them are in a position to fire to 2750° without constructing a special kiln for the purpose.

Mr. Dixon: Mr. Brownlee is right in his theory of a smaller, thinner block. If any of you have had occasion to cut some of the large blocks in half you have noticed that in the larger block, the center is often almost as black as coal. This indicates that the block was not thoroughly dry before it was fired and that in the firing they forgot that all that moisture in the middle of the block had to be driven out. This discoloration in the block is something I do not understand. It has been proved time and again however, that it is due to the moisture left in the block before it is put in the kiln. If the blocks could be fired thoroughly all the way through at about the temperatures to which they are later submitted, it seems to me that they would stand up much better. Sometimes you find in the wall of a tank one or two blocks that have peculiarly stood the test they were put to, much better than all the adjoining blocks, and nine times out of ten it is a block that is well fired.

Consider the conditions to which a 12-inch block in the wall of a tank is

subjected. It has not only the corrosion of the metal on the inside, but it has the higher temperature on the inside and is cool on the outside. Is not that liable to break the structure of the block? We have just heard about the expansion and contraction of the clay. This difference in temperature is bound to break the structure. The block will not stand the heat when it is insulated.

A few years ago Mr. McNeelye, from Australia, told me that during the war they could not get tank blocks for reconstruction of their tanks. They had to go out of business for a while. Finally they discovered a bed of sandstone which they thought might serve the purpose. They cut the sandstone into blocks. These sandstone blocks outlasted any clay blocks they had had. The stone was very close grained soft sandstone. It could be cut with a saw. It hardened as it got dry, but it did not seem there was any particular quality in that stone that would make it last longer than clay blocks.

The Old Dominion Glass Company had two tanks in operation built of silica brick. They generally lasted two years before needing repairs. These furnaces were like big canal boats. They had a crude sort of producer on one side and a port leading directly into the tank. They did not have a bridge; simply boots deep enough to skim the glass. The brick stood up in that stew pot, as I called it, for more than two years.

They were so impressed with the idea that silica brick were better than clay tank blocks that they insisted on the use of silica brick in their modern furnaces. We took the precaution to build the furnace such a way that the silica brick could be easily removed and clay blocks substituted. We built a furnace that ran much higher in temperature than the old furnace. Five weeks after it was started, I got a telegram to hurry a set of clay blocks to them. The silica brick had melted away and were almost all gone.

The block people are constantly trying to improve their products. All of them recognize what they are up against. They are required to meet conditions now that never existed before in all their experience. They have nothing with which to make blocks except the raw material in the ground. All they can do is to improve their treatment and improve their methods of making blocks. The service which tank blocks have to give today is twice as much as they formerly had to give.

Mr. Ross: If we fire blocks as dense as a pot that has been in service a few weeks, is it not probable that we shall have to give very careful attention to the thermal strains set up during heating and in use?

Mr. Yung: No tank is stronger than its weakest point. It may be the life of the water cooler, but not the life of the blocks that determines the life of the tank. What do we mean by the life of a tank?

The heating schedule seems to me to be of most importance in tank operation. The expansion of a clay block or of a silica brick is not the same

throughout the entire range of heat treatment and vitrification. There are two points which are the most delicate. The first is the water smoking period, so called. It is a matter of safety that the lag between the temperature of the block and the temperature of the furnace has to be carefully overcome. This water smoking period is from the start of the fires up to 300°C. The second critical stage is from 500 to 600°C. This is the temperature of dehydration and oxidation. Beginning here also is the breaking down of the clay molecule.

The point I wish to bring out is that a straight line preheating schedule may or may not be a good practice. The practice I have adopted is to run from atmospheric temperature to 300°C at a rise of $2^1/_2$°C per hour, and from there on up to melting temperature at the rate of 10 to 12°C per hour.

Another important thing is the firing the clay pots and block at highest possible temperature. Also of importance is the method of filling the tank while heating up. The schedule I have adopted includes a two day soaking heat at the highest temperature. That soaking heat is the maximum temperature that the furnace will stand—perhaps, in the neighborhood of 1500 and 1550°C. This seems to have a marked effect upon the lasting qualities of the tank.

At the start the glass is put into the tank for glazing purposes. It is banked up against the side, and the total bulk of cullet put in is only sufficient to cover the side wall. When melted it amounts to about 2 inches on the bottom. Another method I have seen used is to shovel in the cullet in a uniform layer practically filling the tank. There is a marked difference in the corrosion by the two procedures. With the cullet filled to the metal line the joint between the first and second course gets a very light firing and I think this is the cause for increased corrosion at the joint.

Mr. Williams: We should decide to bring in enough discussion or information to next year's meeting to decide two points. The first point regarding tank blocks is, what percentage of the loss or wearing away of the tank block is corrosion and what percentage is erosion. The next point is that which Mr. Yung has just emphasized *viz.*, what are the relative kinds of results, or the type of result, the finished result, from different methods of heating up the tank in the beginning. That seems to me to be very important. If Mr. Yung's observations hold generally it is very important. Indeed, it seems to me that 90% of the loss of our tanks is due to corrosion or to the lack of refractoriness, and 10% to erosion. If this is true we should immediately begin to consider refractoriness of the blocks of prime importance.

I suggest that whoever has charge of the program next year should remind the members of the Division that we would like to have all the information possible about these two subjects. Refractories to the glass maker

means a great many dollars and cents, and it would be worth while continuing these discussions, but let us bring them down to a couple of definite points and not range all over the many defects.

Further Discussion on Selenium

By R. R. Shively

I have listened with interest to the discussion of this subject by the previous speakers. Having used selenium for a number of years, I have given consideration to possibly every phase of its use and have at last decided that there is no one thing that one can say is the cause of the tank blocks not lasting as they formerly did. It is my opinion that there has been a decided improvement in the tank furnaces during the past few years. The furnaces now being built are capable of higher temperatures and my experience leads me to believe that practically all glass manufacturers are inclined to play safe and run the tank as hot as it can be run. In several instances the actual temperature being carried is close to 2800°F and at present there is no refractory that will withstand this temperature over a long period.

I know of one instance where a tank was operating at a temperature of 2750° and only lasted eleven weeks. This same tank was rebuilt with blocks from the same manufacturer and operated over a period of twelve months at a temperature of 2550°. You might be interested to know in this particular case that they were able to get as much tonnage at 2550° as they had previously secured at the higher temperature. Of course in this instance it means that the tank was not being pulled up to capacity at the higher temperature.

With reference to this particular phase of the subject, I recently had a letter from the superintendent of a very large factory who informed me that up until two years ago, the life of their tanks averaged eighteen to nineteen months, but since that time they had increased the pull on the tanks from thirty to fifty tons in 24 hours and in order to do this, it was necessary to increase the temperature 200°, and as a result the life of the tanks was reduced to twelve months. Just within the past few days, I have talked with a very prominent manufacturer who claims that he does not now get the life out of tanks which he formerly got on manganese, but in this discussion he told me of the wonderful improvement in his tanks and of the high temperature which he could now obtain.

Within the past four or five years, there has been a very decided improvement in the heavy chemicals supplied to the glass manufacturer. Today, at least some of the soda ash manufacturers are supplying soda ash that analyzes not less than 99.5% sodium carbonate and this is being fur-

nished in granular form in which all of the fines have been screened out, and it is my belief that this has greatly reduced the volatilization losses of soda, which together with a greater purity being supplied, increases materially the soda content in the finished glass.

The high alkali glasses have undoubtedly more fluxing action than those containing a lower percentage of alkali. Due to the educational work of the National Lime Association, burned lime is now being supplied which has an ignition loss of only approximately 2%. This means that the manufacturers are getting more lime in their glass and this too may have its influence on the rapid fluxing of the blocks. Unquestionably all of the members of this Division realize that in the past few years, practically all of the manufacturers have introduced mechanical feeders and machines for shaping the glass. The results have been that the pull on the tanks has been increased and the tanks are now operating six days a week without any stops, consequently there is a constant drag in the walls and I do not believe it can be disputed that erosion has considerable to do with the wearing out of the blocks. When the tanks were worked by hand, there was always a stop in the morning from two to seven which permitted the glass to plain and which always gave an opportunity to change the direction of the pull. There seems to be an over production of glass at the present time and competition is very keen. Labor costs are high, chemicals are high, fuel is more expensive and yet the finished ware is selling at reduced prices. The results have been that the manufacturers have tried to overcome these conditions by increasing their production and in order to do this, they have resorted to higher temperatures and in some cases, more soda and naturally the life of their tanks has been reduced.

Recently an old glass manufacturer remarked to me that better looking tank glass is now being made than the pot glass which was produced ten years ago. The results being obtained are really beyond belief. When this is taken into consideration along with the fact that the saving in the use of selenium amounts to not less than one dollar a ton on the glass melted, it can be readily seen that on a twenty-five ton tank, operating for eight months, the savings will be sufficient to rebuild the tank.

On account of the superior results obtained with selenium and this saving, I do not anticipate that many manufacturers will go back to the manganese even if its use could be proven to give longer life to tanks which I doubt would be found the case under present operating conditions.

If you will please excuse the common parlance, I do not want to be understood to be "passing the buck" to the block manufacturers, but I believe that if they would take more interest in educating the user of their product as to the correct way to bring up the tanks, better life would be obtained from the blocks.

In summarizing these remarks, it impresses me as a round robin proposition. The glass manufacturer has appealed to the tank builder because his tank does not last, the builder in turn blames the block and the block manufacturer attacks selenium because it is the only new substance generally used in glass. Selenium has served the manufacturer well at a time when it was badly needed and unless I am grievously misinformed, the results obtained and its monetary savings shown, justify its continued use.

It is impossible to determine the amount of selenium actually necessary for decolorization. The average amount used in the batch is less than one part in 80,000 parts of finished glass and as some of this is lost by volatilization or oxidation, it is quite impossible to find by analysis the amount of selenium remaining in the finished glass.

A few manufacturers do not use arsenic and the amount of selenium required for their batch is unusually small. I know of one factory where raw materials of low iron content are used, that requires but .125 ounces of selenium combined as a selenite, to decolorize a thousand pounds of sand. Another factory not using arsenic, but using the element, requires but .25 ounces of selenium for a thousand pounds of sand. Where the average amount of arsenic is used, two pounds to the thousand of sand, the amount of selenium required to the batch is about .4 of an ounce. Where a selenite is used, even a smaller quantity is required. It can be seen from the above facts, that very little selenium is required for decolorization, and if any unusual amount of it is lost through furnace conditions, it would seriously affect the color.

As to the properties of selenium, it melts at 217°C, it burns in the air with a bluish red flame, forming selenium dioxide, and boils at 690°C. From these properties it would be expected that some of the selenium introduced in the furnace is lost by volatilization, and in the case of a tank operating under oxidizing conditions, some of the selenium may combine with oxygen and the selenium dioxide carried out with the stack gases.

Let us consider for the time, ruby glass, where a much larger amount of selenium is used. Ruby batches made in pots require much less selenium than those made in day tanks. In the latter case, I am informed that everything depends upon the flame—a certain batch may give a good glass one day, and the next melt may be unfit for use. The fumes of selenium can be seen escaping from these tanks. If, where larger amounts of selenium are used, the operation of the furnace is so important, it certainly has its influence in a lesser degree where small quantities are employed.

It has been my experience that the hotter the tank is run, the less selenium is required for decolorization. This may be explained by the

fact that where high temperatures are obtained, the furnace is being operated efficiently and a neutral condition is maintained within the furnace.

Unquestionably tank conditions affect selenium decolorization. Constant temperatures and uniform furnace conditions must be maintained in order to get the best results.

WASHINGTON, PA.

DISCUSSION ON "STUDIES OF THE THERMAL CONDUCTIVITIES OF SOME REFRACTORY MATERIALS"[1]

J. SPOTTS MCDOWELL: In this paper, the mean conductivity between 650° and 1250°C is given as follows:

Silica brick...................	0.00099
First quality fire-clay brick....	0.00169

The conductivity of silica brick therefore appears to be about 58% that of fire-clay brick.

O. T. Green[2] found the conductivity of silica brick to be about 80% that of fire brick. Other investigators, including Boyd Dudley[3] and Goerens and Gillis,[4] report it to be 15 to 25% higher than that of fire brick.

In this connection, it is well to refer to the fact pointed out by W. A. Hull[5] that the conductivity of the refractory is only one of several factors working in series which determine the amount of heat flowing through a wall. Other factors are the "diffusivity," the effects of joints and surface resistance, of the luminosity of the flame, draft conditions, whether positive or negative, absorption by the refractories of material from the gases, and glazing or vitrification of the hot surface of the brick.

In furnace practice it is known that more heat will pass through a silica wall than through one of fire-clay brick of equal thickness. The use of silica brick in by-product coke ovens has shortened the coking time. In a paper by F. A. J. Fitzgerald,[6] some interesting figures are given. Furnaces were constructed of hollow cubes with external sides of 230 mm. and walls 60 mm. thick. The furnaces were supported on knife edges so that all sides were exposed to the air, and were heated by nichrome resistance

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[1] *Jour. Amer. Ceram. Soc.*, **7** [1], 19(1924).

[2] "The Thermal Conductivity of Refractory Materials at High Temperatures," *Trans. Cer. Soc.* (Brit.), **21**, 394(1921–22).

[3] *Trans. Am. Electro-Chem. Soc.*, **27**, 336(1915).

[4] *Ferrum*, **12**, 1, 17(1914).

[5] W. A. Hull, "Thermal Conductivity of Refractories," *Chem. Met. Eng.*, **27**, 538 (1922).

[6] *Trans. Amer. Electro-Chem. Soc.*, **22**, 110(1912).

wires. The following figures represent the amount of energy required to maintain constant temperature conditions within the furnace.

	Watts lost through walls, temperature °C		
	500°	700°	800°
Fire brick	475 w.	770 w.	930 w.
Silica brick	565	920	1100
Magnesia brick	860		

	Ratios: Heat lost, temperatures °C		
	500°	700°	800°
Fire brick	1.00	1.00	1.00
Silica brick	1.19	1.19	1.18
Magnesia brick	1.81	....	....

Another way of comparing these results is as follows:

With a power input of 860 watts, the following temperatures could be maintained in the furnace:

Magnesia Lining............	500°C
Silica brick lining, about.....	670°C
Fire brick, about............	755°C

DEFINITION OF THE TERM CERAMICS AND PROPOSAL OF INTERNATIONAL STANDARDS

RUDOLF BARTA (Dr. Ing.):[1] The Czechoslovak Ceramic Society sent its delegates to the International Congress for Applied Chemistry in Copenhagen, Denmark. I shall mention the point of view which we have in respect to the treating of the Ceramic Division:

1. Name "Ceramic"

The Czechoslovak ceramists are well informed of the suggestion of the commission of the AMERICAN CERAMIC SOCIETY that the name "Ceramic" may be used also in other branches than clay working.

This proposal follows the aim of simplifying the denomination for relative branches of industry. This proposal has however met with certain difficulties:

(1) The way of production in cement, lime, glass and enamel branches rather differs from that of clay working.

(2) The denominations of cement, lime, glass, enamel, etc., are in general use, and by them are directed the international contracts, railway-tariffs, custom-tariffs, statistics, etc.

(3) The introducing of the American proposal would cause changes in the international relations correspondence and record. It may even cause chaos, and a certain chaos in business connections.

If there is the endeavor to introduce a common denomination for the branches of clay working, cement, lime, glass, enamel, etc., then according to our opinion it would be better to choose quite a new denomination. After the proposal of Prof. Dr. Ing. O. Kallauner, it would be for instance "silicates and the respective branches," or abbreviated "silicates"—as it is already in use in Czechoslovakia. Perhaps another more suitable denomination will be found.

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[1] General Secretary of the Czechoslovak Ceramic Society.

2. Nomenclature

The Czechoslovak Ceramic Society welcomes the proposal that in all countries commissions be appointed for standardizing ceramic nomenclature. These commissions should be in connection with the international one, in order to effect unity.

3. Designations of Types and Specifications

Czechoslovak Ceramic Society consents in principle that the types of ceramic raw materials may be fixed. It will have a considerable importance in furthering scientific research.

For the international types the Czechoslovaks recommend of their raw materials the china-clay of Sedlice (Zettlizer kaolin) and blue clay of Vildstajn (Wildsteiner Blauton). Both are of equal quality, well known in the world, and a whole series of scientific experiments was made with them.

Besides we beg to recommend that types of local importance be fixed in every respective country.

4. Technological Works

Messrs. Le Chatelier and Lapsa have proposed to compile a certain number of works on ceramic technology. This in Czechoslovakia is not considered as pressing. We beg to draw your attention to some works done in the United States.

For instance, works on chemical analysis of silicates could scarcely be made better than those of Hillebrand, etc.

5. Proposals of Czechoslovak Ceramic Society

To the international conference in Copenhagen the Czechoslovak Ceramic Society has sent these four proposals:

(*a*) Make the comparative experiments between the tests in laboratories and tests in practice.

It is known that the tests on specimens formed in laboratories give different results from tests executed by the same methods on the same raw materials in practice.

Such comparative tests have already been introduced by the Czechoslovak Ceramic Society. The head-man of these investigations is Prof. Dr. Ing. O. Kallauner.

(*b*) It would be advisable to make the international unification of ceramic testing.

(*c*) The elaborating of an International Ceramic Chart would be of significance. It should contain the chief deposits of ceramic raw materials and the chief factories. A list with explanations should accompany.

(*d*) By noting of the ceramic formulae it is recommended to state not only the chemical and rational composition, but also the analysis of grain size, etc. These would make the descriptions of one meaning.

Dr. E. W. Washburn:[1] I have read the recommendations of Dr. Barta. I believe his suggestions and comments, under Nos. 2, 3, 4 and 5, are excellent and well taken.

With regard to No. 1: His principal objection to the definition of the term "Ceramic" is based upon the difficulty which would be caused in business relations. This objection was brought up and thoroughly discussed at the meeting of the Committee of the International Union which passed upon the question and because of this difficulty the Committee voted to approve the definition *for scientific and technical purposes only*, not for business or trade purposes. With this limitation on the definition the objections of Dr. Barta no longer hold.

[1] Recd. July 21, 1914.

REFRACTORIES QUESTION BOX[1]

E. E. Ayars, Editor

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?
2. What difference is there between the properties of a soft mud machine made and a hand-made brick?
3. Can an iron-free clay brick be made for blast furnace service?
4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?
5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?
6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand-made fire brick?
7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?
8. What is the reason for the more rapid failure at a lower temperature of fire brick subjected to reducing atmosphere than will obtain with the same brick under oxidizing conditions?
9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?
10. At what temperature does fire clay break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_3$-$2SiO_2$?
11. What properties should a clay brick possess to give good service in rotary cement kilns?
12. What properties should a clay brick possess to give good service in vertical shaft lime kilns?
13. How can the water content for wet pan charges be gaged?
14. What simple laboratory tests can be used to keep the quality of refractories up to standard?

Question

How can the water content for wet pan charges be gaged?

Discussion

The following extract is taken from a paper, "How Good Silica Brick are Made," published in *Brick and Clay Record*, October 16th (1923).

"European silica brick manufacturers have realized the importance of standard grinding practices and much has been done to develop methods of scientific control. The grinding is usually done in medium sized wet pans driven by individual motors. The motors are severally connected with recording ammeters which have charts in plain view of the pan oper-

[1] See note, *Bull. Amer. Ceram. Soc.*, **3** [7], 258(1924).

ator at all times. By experimental runs the desired size of grain, quantity of water and length of run was determined. The ammeter record charted the course of each grind and a standard chart was adopted for daily use. This method insures uniform grinding and tempering results. In one case the first five minutes of the cycle is consumed in dry grinding, ... The reduction in amperage is very noticeable when water is added and when the recorder pen recedes to a certain specified point the water is turned off. The grind then continues about fifteen minutes until at a predetermined point in the cycle the pan is emptied and a new dry batch of material added. Very accurate results should be obtained with this method. By referring to the ammeter chart one may note the relative power consumption of an empty pan and of both the wet and dry grinds."

It appears that the method described for silica brick can be easily adapted to the tempering of fire clays, although another means of indicating the power consumption of the individual pan would have to be devised in the case of line shaft drives. Such an indicator could be developed by a good instrument maker.

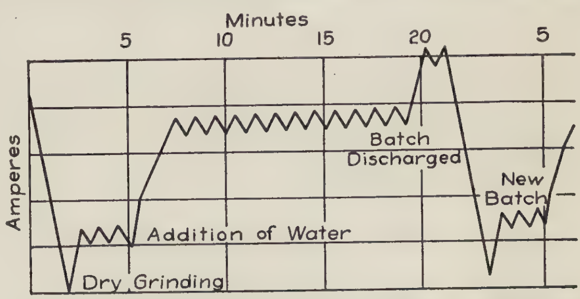


Fig. 1.—Ammeter chart used in European works to provide uniform grinding and wet pan tempering of silica brick mixtures. A 20-minute cycle is used which was determined by experiment to give the results required. Can be adapted to wet pan tempering of fire clay mixtures.

This method automatically takes care of the variations in the moisture content of clay from the storage pile or mine, a problem which has precluded the possibility of obtaining uniform results by weighing the charge and the water to be added.

It has been established that concrete mixtures should contain just enough water to wet the material through thoroughly, and tests have been developed to check the consistency of the mass. The "Slump Test" as applied to concrete consists in filling a conical cylinder with the mixture and striking the excess material from the bottom of the inverted cylinder. Placing the cone on a board the metal shell is removed and set down beside the test piece. By placing a rule across the top of the mold and measuring down to the top of the test piece the amount of settle is determined, and this indicates whether or not the mixture has the proper amount of water in it.

A similar test might be developed for testing the consistency of clay from the wet pan. However the fact that clay is plastic and not liable to settle

enough to form a basis of judgment it would be necessary to use some sort of apparatus to exert pressure on the test piece.

The Vicat needle may suggest a possible test.

However the use of such tests as this takes more or less time and probably would not operate within fine enough limits to be of as much value as the recording indicator as used in Europe.—Ed.

Question

What simple laboratory tests can be used to keep the quality of refractories up to standard?

Discussion

The simplest test and one which has a direct bearing on size of grain, water content and molding methods, as well as temperature and speed of drying, is the green brick modulus of rupture. The green brick modulus may be correlated with the burned brick modulus of rupture and other tests. Results recorded on daily tests which do not fall between certain well defined limits are known to have been taken on a product below standard.

Assuming that the chemical analyses of the various clays entering the brick mixture are correct and the proportions properly taken, one test which indicates the uniformity or lack of uniformity of the manufacturing treatment should be sufficient check on the quality of the product. The test should be taken at various specified intervals during the day.

The test suggested will also indicate variations in the proportions of clays in the mixture. For a more complete discussion refer to Question Box department for May and July "Laboratory Control in the Manufacture of Refractories," *Bull. Amer. Ceram. Soc.*, **3** [5], 162–168(1924), and **3** [7], 259–261(1924).—Ed.

With further reference to the discussion of the failure of fire brick checkers in oil-fired boiler furnaces which appeared in the August number Question Box, R. F. Ferguson of Bolivar, Pa., formerly with the Refractories Industrial Fellowship at Mellon Institute, has submitted the following information, which has at his request been written up by the editor. Conclusions drawn are by the editor. The study of refractories failures in oil-fired boilers has included analyses of the slags formed, to provide a basis for the solution of the problem. In such investigations the slags have invariably been found to contain high percentages of titania varying from 6 to 10 per cent. This is much in excess of the usual percentages found in fire brick, which seldom if ever exceed 2 per cent titania. Some samples examined also contained small percentages of vanadium in addition to the titania. Several check determinations were made in the laboratory before the analyses were accepted as the high titania content and

especially the presence of vanadium had not been reported in any previous investigation which had come to the notice of the chemist, or the client.

The source of the slag samples cannot be identified at this time and the condition of the refractories from which the slags were collected was not recorded at the time of analysis. The analyses of brick used were furnished as a part of the working data and for comparison with the slag analyses results. Samples of slag submitted were taken from different parts of the country and while the oils in use were not specified and no analyses furnished it seems fair to assume that several representative grades of oil from the various fields were used.

In this connection there has come to the editor's attention a report of some recent work by the Northern States Power Company, "The Effect of Coal Ash on Refractories" by J. J. Brennan.[1] It appears that fuel oil residue should bear a close relation to coal ash, and in the absence of any exact analyses of fuel oil residues the following discussion assumes that the compounds present are essentially the same as are found in coal ash.

The Northern States Power Company studied the effect of ash from nine different coals on fire brick. Test cones were made using 70% of 60-mesh ground fire brick and 30% of 60-mesh coal ash. Nine coals commonly used in power house work and 42 different brick were examined. Analyses of representative brick were made, and the complete analysis of each coal ash determined. Test cone mixtures for each brick were made with each of the nine coal ash samples. Careful fusion tests were run off and the results plotted. The information presented is very interesting.

A review of the coal ash analyses shows the following variations: Silica 38.70% to 55.01%; Alumina 21.76% to 30.75%; Titania and iron (reported together) 6.07% to 23.14% (five analyses showed 6.00 to 10.00% titania and iron, while the remaining four showed 15.67% to 23.14%); Lime 1.15% to 11.47%, the average being 6.04%; Magnesia 0.90% to 2.59%; Sulfur trioxide 0.57% to 7.06% the average being 3.71%; alkalies 1.08% to 3.48% (3 samples undetermined).

Fire brick analyses on 14 samples showed a silica content varying from 25.65% to 61.58%, alumina content from 34.60% to 70.51%, titania and iron from 0.32 to 5.70 (the average being 2.03%). More complete analysis of eight samples showed variations of lime from 0.33 to 0.61%, magnesia 0.26% to 2.91%, alkalies 0.45% to 1.55%.

After a hasty study of the charts on which the results with each set of cones were plotted the following conclusions are drawn by the Editor. First: That the coal ash containing high percentages of titania and iron were most destructive to fire brick. Second: That fire brick containing

[1] Published in June, 1924 issue of *Combustion*, Combustion Publishing Corporation, 43 Broad Street, New York.

high titania and iron were more readily attacked by the coal ash. Third: That fire brick having a high silica content are most susceptible to attack by the coal ash than those brick having an alumina content of 45 per cent or more. Fourth: That there are some inconsistant results which occur when the magnesia and lime contents of both brick and ash are high. In this case low fusion points were obtained where the high magnesia and lime of both substances crossed.

The brick showing the highest resistance to the effect of the ash in all cases has the following analysis; silica 25.65, alumina 70.51, titania and iron 1.90, lime .61, magnesia .49, alkalies .84, and this brick has been adopted as a standard lining.

The author of the article cited above stated that the problem was not one "in which chemical quantities can be assumed, and no attempt is made to impose a theory to indicate, from a purely chemical standpoint, the effect of coal ash of fire brick." In his summary he states that "the actual performance of a number of brick tested has been observed during the past two years and in a majority of cases the actual life of furnace linings follows very closely the indications given in the chart."

However the data presented would permit of more careful study. The same procedure may be extended to fuel oil residues where without doubt much the same results will be encountered. The Northern States Power Company used this method to select the best brick for their purpose but there is a great deal of information in the results which has not been interpreted, and it may be the foundation for which the industry has been looking, on which to build a perfect boiler refractory.—Ed.

Question

What is the fusion point and specific gravity of tridymite? Of cristobalite?

	Tridymite	Cristobalite
Fusion point	1670°C (Searle)	1625°C (Searle)
Sp. G.	Artificial tridymite, 2.27 (Fenner) Natural tridymite, 2.28 (Mallard)	Artificial cristobalite, 2.333 (Fenner) Natural cristobalite, 2.34 (Mallard) 2.32 (Searle)

ACTIVITIES OF THE SOCIETY

NEW MEMBERS RECEIVED FROM JULY 15 TO AUGUST 15

PERSONAL

Bramhall, Riley, Holmesfield, Sheffield, England, Works Manager, Moor Edge Silica Brick Works.

Carrie, G. M., Magnesite-Prov. Quebec, Canada, General Manager Scottish Canadian Magnesite Co., Ltd.

Corman, Julian, 1808 Walnut St., Murphysboro, Ill., Ceramist, Isco Bautz Silica Co.

Frazier, John Earl, Clarion, Pa., Chemical Engineer, Berney Bond Glass Co.

Le Heron, Revin (Ardennes), Director, Des Etablissements Porcher.

Lukens, Glenn, 502 E. Chapman St., Fullerton, Cal., Instructor.

Lyons, Sanford C., Bennington, Vermont, President, Vermont Kaolin Corp.

Simpson, Harold E., 87 Tibet Road, Columbus, Ohio, Student.

Weaver, Eduard E., 151 Alabama Ave., Providence, R. I.

Membership Workers' Record

	Personal
Howells Frechette	1
William Hugill	1
C. W. Parmelee	1
John Sawyer	1
Office	5
Total	9

THE SUMMER MEETING

Fred B. Ortman, general chairman of the 1924 Summer Meeting Committeew rites that the California members are looking forward to October 6 and 7 with great anticipation. They are doing more; they are making sure that the realization will equal the most exaggerated anticipations.

Two days' program of technical papers and plant visits followed by directed plant tours as those in attendance will choose are on the schedule of events.

Round trip tickets at excursion rates will be available. Ask your local railway agent for routes and rates with Hotel Biltmore, Los Angeles, Calif., October 6 and 7 as your objective.

RESEARCH COMMITTEE MEETING—ENAMEL DIVISION

(American Ceramic Society, Held at Hotel LaSalle, Chicago, Illinois, on July 7, 1924)

PRESENT—MEMBERS OF COMMITTEE

M. E. Manson,
Rundle Mfg. Co.

W. G. Lindemann,
Lindemann & Hoverson Co.

BY INVITATION:

P. H. Bates,
Bureau of Standards.

C. M. Pearson,
Pickands Brown & Co.

E. P. Poste,
Pfaudler Co., Elyria Division.
L. G. Wassman,
Wolff Manufacturing Co.
Homer F. Staley, Chairman,
Metal & Thermit Corporation.
J. A. DeCelle,
Chicago Hardware Foundry Co.
R. C. Boyd,
Chicago Hardware Foundry Co.
R. R. Danielson,
Lindemann & Hoverson Co.

Presiding Officer: R. R. Danielson, Chairman of Enamel Division.

The Chairman of the Committee gave a brief résumé of the chief research work to be undertaken this year. This is an investigation of the relations between the composition and structure of cast irons and their enameling properties. The Bureau of Standards has consented to do a large amount of research work on this problem with the advice and coöperation of the Enamel Division. The Metallurgical, Ceramic and Chemical Divisions of the Bureau will take part in the investigation.

After some discussion, it was decided that the first series of experiments should deal solely with the relations of structure in cast iron as effected by the percentage of scrap used in producing it and by the number of times the iron has been remelted, when the chemical composition is kept uniform. Other phases of the subject will be taken up later.

The following tentative program, subject to modification by the Bureau of Standards, was approved.

Cupola Melts

Series 1.—To find the effect of varying percentages of scrap in melts.

Melt 1.—100% Pig Iron. Part of this to be used in the following melts as scrap.

Melt 2.—20% Scrap
Melt 3.—40% Scrap
Melt 4.—50% Scrap
Melt 5.— 60% Scrap
Melt 6.— 70% Scrap
Melt 7.—100% Scrap

Series 2.—To determine the effect of repeated meltings on structure of iron. A certain amount of pig iron will be melted and test samples made. The remainder, with the addition of only enough raw pig iron to bring the composition back to that of the original mixture, will then be remelted in the same manner five or six times unless the iron becomes unworkable in a fewer number of melts.

Series 3.—Will be the same as Series 2 but with the use of soda compounds in the ladle to keep down as much as possible the gradual increase in sulfur due to remelting.

Composition Desired in all Castings:

Silicon	2.25 plus or minus 0.10
Sulfur	0.10 plus or minus 0.02
Phosphorous	0.65 plus or minus 0.05
Manganese	0.50 plus or minus 0.05

Coke.—Solvay coke containing 0.50–0.60 sulphur, ash 7–8%.

Cupola Practice.—To be kept as uniform as possible. $2^1/_2$% of high calcium limestone is to be used as flux.

Molding of Castings

Castings.—3″ × 6″ × $^3/_{16}$″. Cast four on a gate with the use of a spoon gate. Albany No. 1 sand to be used. No facing to be used. At least 50 castings to be made

from each melt. The method of molding and the pouring temperatures are to be kept as uniform as possible and the castings are to be allowed to cool in the mold until black.

Test Bars.—Standard foundry test bars are to be poured from each melt and subjected to the usual test for the determination of the mechanical properties of the iron.

Study of Castings

The Bureau of Standards will make complete metallographic and chemical studies, including determination of gas content, of representative castings from each heat. The results of these studies will be coördinated with similar studies of castings from the same heats after enameling and with the results of the enameling tests.

Enameling Tests

Enameling tests will be made in the Ceramic Division of the Bureau of Standards and also in the following plants:

MEDIUM TEMPERATURE—DRY COAT

Wolff Manufacturing Co.
Direction of L. G. Wassman

Rundle Manufacturing Co.
Direction of M. E. Manson

WET COAT ENAMELING WITH USE OF GROUND COAT

Lindemann & Hoverson Co.
Direction of R. R. Danielson

LOW TEMPERATURE—DRY COAT

Chicago Hardware Foundry Co.
Direction of J. A. DeCelle

HIGH TEMPERATURE—DRY COAT

Pfaudler Company—Elyria Division
Direction of E. P. Poste

WET COAT CAST IRON WITHOUT USE OF GROUND COAT

Porcelain Enamel & Mfg. Company
Direction of Karl Turk

All samples are to be cleaned by sand blasting just before enameling, are not to be annealed, are to be enameled on the drag side of the casting and are to be returned to the Bureau of Standards with detailed descriptions of methods employed in enameling. In all cases, commercial enamels are to be employed but the composition of the enamels used will not be divulged.

The Chairman of the Committee will visit the Bureau of Standards in the near future to discuss the details of this program and will advise the Committee members if there is any material modification to be made.

Yours very truly,

HOMER F. STALEY, *Chairman*,

Committee on Research, Enamel Division, AMERICAN CERAMIC SOCIETY.

REPRESENTATIVE ON DIVISION OF CHEMISTRY AND CHEMICAL TECHNOLOGY NATIONAL RESEARCH COUNCIL

Dr. Wm. M. Clark, Chairman of the Research Committee of the SOCIETY has been appointed representative of the SOCIETY for a term of two years on the Chemical Division of the National Research Council.

ARTHUR FREDERICK GREAVES-WALKER

Director, Department of Ceramic Engineering North Carolina State College, Raleigh, N. C.

A department of ceramic engineering at North Carolina State College was authorized last year by the legislature and funds provided for equipment of an instructional staff. There is the assured financial support necessary to permit the department developing to the maximum facilities and service.

Mr. Greaves-Walker, after several months of negotiations, has been prevailed upon to direct this new educational department. He will also retain his interests with Stevens, Incorporated.

Mr. Greaves-Walker has an international reputation as a ceramist through his publications. He has proven his ability to manage and to solve production problems. His personality and progressiveness insures for him a place in the front rank as an educator and investigator. North Carolina State College is fortunate in having secured Mr. Greaves-Walker to direct the affairs of this new department. For a personal sketch of Mr. Greaves-Walker see *Jour. Amer. Ceram. Soc.*, **6** [1], 44(1923).

H. G. SCHURECHT LEAVES MELLON INSTITUTE

H. G. Schurecht, Senior Incumbent of the Multiple Industrial Fellowship sustained in Mellon Institute of Industrial Research by the Clay Products Association and the Eastern Clay Products Association, has resigned to accept the directorship of the research laboratory of the National Terra Cotta Society. While Mr. Schurecht assumed his new duties on September 1, it is understood that the selection of his successor has not been made by Mellon Institute.

NECROLOGY

Max F. Abbé

Announcement has been received of the death of Max F. Abbé, Chairman of the Board of Directors of the Abbé Engineering Company, on July 3, 1924. The Abbé Engineering Company has a corporation membership in this SOCIETY.

T. Wilfred Owen

T. Wilfred Owen, also a member of the SOCIETY met death recently by drowning. Mr. Owen was Ceramic Engineer for the Queen's Run Refractories Co., Inc., at their Lock Haven, Pa., plant.

BIBLIOGRAPHIES ON REFRACTORIES

The Refractories Division of the SOCIETY has ready for distribution a Bibliography of Magnesite Refractories. It has a Bibliography of Silica Refractories in the press. Several hundred references and abstracts are in manuscript form for a Bibliography on Clay Refractories. Bibliographies of other types of refractories will be compiled.

The Bibliography on Magnesite Refractories may be had by sending 10 cents postage to office of the SOCIETY's General Secretary, Lord Hall, O. S. U., Columbus, Ohio.

THE GEOLOGICAL SURVEY COMMITTEE

The Geological Survey committee is preparing for early distribution (1) a directory of dealers of ceramic materials and (2) a bibliography on clays. The Committee will welcome suggestions and information. Address Dr. S. L. Galpin, Iowa State University, Ames, Iowa.

FELDSPAR INVESTIGATION

The Bureau of Standards with some of the universities and industrial laboratories collaborating will investigate the properties and constancy of the feldspars. This is being done at the suggestion of and in coöperation with the AMERICAN CERAMIC SOCIETY.

There is "malice toward none and charity toward all" in this investigation. With eye simply on the best welfare of all, the White Wares Division of the SOCIETY has made honest effort to get to the facts regarding the availability and quality of domestic feldspar. The facts "must out." In no other wise will the ceramic manufacturers be able to produce the best ware possible and in no other wise will the feldspar producer know the use to which his products is best fitted. An illuminating lamp to the feet of both producer and consumer is the only purpose of these investigations.

The scheme and scope of investigation which is now being undertaken is set forth in the communication from Dr. George K. Burgess, Director of the Bureau of Standards. This is but one portion of the investigations to be undertaken. It is the most logical "next step." A cursory review of the milling practices has already been made and reported. This will be followed by a survey of the feldspar resources with chemical, physical, microscopic and service studies of field samples illustrative of the extent and uniformity of deposits.

Full and frank coöperation in these investigations will be given by all who are willing to do business on the basis of "the truth, the whole truth and nothing but the truth."

Enclosed you will find a brief outline of an investigation on feldspar which it is proposed to conduct at this Bureau. The investigation is to be coöperative with the AMERICAN CERAMIC SOCIETY and, as the outline indicates, is divided into two major parts.

The first is to be coöperative with other institutions and comprises tests suggested by the Whiteware Division of the CERAMIC SOCIETY. It is believed to be very desirable to determine the factor of experimental error in the determination of softening points, and chemical and screen analyses, by comparing data on the same samples from at least five separate sources. In addition, the Bureau will determine the actual fusion points (expressed in °C) and conduct an "air analysis" on all feldspars submitted.

The second part comprises tests which will be conducted solely at the Bureau and will be comparable with previous Bureau investigations of ball clay, whiting, and flint.

It has been suggested by Mr. R. V. Miller (Knowles, Taylor & Knowles Co.), as the representative of the AMERICAN CERAMIC SOCIETY, that we obtain from you a sample of each of the following feldspars: (Feldspars listed.)

The Bureau and the SOCIETY will greatly appreciate your coöperation in this matter. It is requested that you forward not less than a 100-pound sample of each of these feldspars, prepaid, to the Bureau of Standards, Washington, D. C., attention IX-I-F.

Respectfully,
(Signed) GEORGE K. BURGESS, *Director*.

FELDSPAR INVESTIGATION, BUREAU OF STANDARDS

Part I. Suggested by White Ware Division.
- A. Softening point in cones (coöperative).
- B. Fusion point (°C).
- C. Chemical analysis (coöperative).
  - 1. K_2O–Na_2O–$CaO.MgO$.
  - 2. $SiO_2.Al_2O_3$ ratio.
- D. Screen analysis (coöperative).

Part II. Suggested by Bureau.
- A. Viscosity during softening range.
- B. Effect on body.
  - 1. Burning range in cones and °C.
  - 2. Porosity.
  - 3. Color.
  - 4. Strength.
    - *a* Impact.
    - *b* Chipping.
    - *c* Quenching.
- C. Petrographic examination.

SUGGESTED COÖPERATING INSTITUTIONS

Rutgers College	New Brunswick, N. J.
New York State School of Clay-Working and Ceramics	Alfred, N. Y.
Ohio State University	Columbus, Ohio.
University of Illinois	Urbana, Ill.
General Electric Co.	Schenectady, N. Y.
Onondaga Pottery Co.	Syracuse, N. Y.
Western Electric Co.	Chicago, Ill.

INVITATION EXTENDED BY A.A.A.S.

Since the AMERICAN CERAMIC SOCIETY has become affiliated with the American Association for the Advancement of Science, all the members of the SOCIETY who are not already enrolled in the A.A.A.S. have the privilege of joining the Association without paying the usual five-dollar entrance fee. This privilege will remain open for one full year from October 1 next. We are sure that many of the members of the SOCIETY will be glad to take advantage of the privilege and will become good supporters of the broad aims of the Association. Of course the A.A.A.S. needs the support of all who are interested in the general advancement of science and education and in the coöperation of the numerous sciences toward the improvement of science, education, and knowledge in general.

We wish to call the attention of the members of the AMERICAN CERAMIC SOCIETY to the nature and work of the A.A.A.S. and to the existence of the special privilege mentioned above. After the year above defined is completed the privilege will be restricted to *new* members of the SOCIETY, who will have the privilege till one year after the next October first following their election to the SOCIETY.

NOTES AND NEWS

BUREAU OF MINES NOTES

Silica Investigations

In the course of a general study of the technology of silica, being conducted by the Department of the Interior through the Bureau of Mines, observations have been made recently in the glass-sand and ganister districts of Mapleton and Mt. Union, Pa., and Berkeley Springs, W. Va. Methods of quarrying and mining were studied, including the use of explosives. Although the workings are all open cuts in the glass-sand quarries, loading of ore is done almost entirely by hand. In only a few instances are steam shovels used.

Washing or milling plants for glass-sand are very much standardized in the two districts, with the exception of methods of handling the wet, washed sand. These varied from hand feeding of bucket elevators to overhead traveling cranes with clam-shell bucket. The output of the two districts is almost the same, as far as quality is concerned, as they are mining the same bed of sandstone and using similar methods. One pulverizing plant at Berkeley Springs was visited where the washed sand is ground in tube mills. The product is used almost entirely in the ceramic industry. In all, nine plants were visited in the two districts.

Additional samples of silica were collected and a study begun of the difference in finished product between material ground in batch type and continuous mills. In connection with this, determination of grain size of finished products was made on several samples. Screen analysis and microscopic examination were made on samples of glass sand collected.

The Milling of Garnet

Gravity separation of abrasive garnet from hornblende, minerals which are intimately associated in the New York deposits, presents difficulties owing to the small difference in the specific gravity. It is believed that a detailed study of milling methods would not only be of assistance to garnet producers, but the data obtained from such a study would be useful in its application to problems in the milling of other ores and minerals. Such a study will be undertaken by the Department of the Interior, the work being assigned to the New Brunswick, N. J. and Rolla, Mo. experiment stations of the Bureau of Mines.

Refractory Service Survey at Boiler Plants

R. A. Sherman, Department of the Interior engineer, is making observations in the vicinity of New York City, in the course of a survey of refractory service in boiler-furnace plants being made by the Bureau of Mines. Observations were recently made at Providence and Pawtucket, R. I., and near Boston, Mass. This survey gives promise of definite results in promoting the interest of power-plant engineers in refractory problems and in the obtaining of coöperation of research organizations in solving these problems.

Removal of Sulphur from Ceramic Wares

Under a general investigation into the oxidation of ceramic wares during firing, being conducted by the Interior Department at the Columbus, Ohio, experiment station of the Bureau of Mines, a study has been undertaken on a semi-commercial scale to test methods that have been developed in a laboratory way for the more rapid removal of sulphur from ceramic wares during firing.

Several shales and fire clays have been chemically and microscopically tested for suitability in the work and a procedure has been worked out for a series of semi-commercial burns. A ton of a North Columbus shale which is particularly difficult to oxidize has been obtained and a number of standard bricks made up. They will be fired in lots of fifty each. Preparations are complete for making the required measurements during the firing and of so controlling and varying the temperature and atmosphere as to get the results desired.

It is planned to fire the kiln in forty-eight hours on a compressed schedule adopted from a commercial kiln recently tested. The first few burns will be for the purpose of developing a technique.

Alum from Clay

What is believed to be a much-needed simple, cheap method for the manufacture of pure alum and aluminum salts from impure clays has been devised by Department of the Interior investigators attached to the Pacific Experiment Station of the Bureau of Mines at Berkeley, California. The process, when perfected, should replace present methods in which pure salts cost about twice as much as impure salts.

Large scale tests on the preparation of aluminum sulfate have been completed by the Bureau of Mines. In these tests, using a unit charge of one ton, the results confirm the conclusions drawn from 100-pound runs previously made, in that it is practicable by a preliminary treatment with acid to remove the iron to a mere trace and most of the potash. This leaves an iron-free residue which can be worked up into aluminum sulfate. Alunite consists of aluminum and potassium sulfates, with iron and other minerals present as impurities. Removal of the iron has been the most difficult problem. Experiments are being continued with the object of determining the best conditions of temperature, pressure, and other factors for maximum efficiency of the process.

Mineral Fillers

A study of the size and character of grains of non-metallic mineral fillers has been completed by the Department of the Interior at the Southern Experiment Station of the Bureau of Mines, Birmingham-Tuscaloosa, Alabama. Mineral fillers are those non-metallic minerals that, after being pulverized, are used in the preparation of various manufactured articles. Kaolin, whiting, chalk, ground limestone and marble, silica, ocher, mica, talc, barite, slate flour, graphite, and diatomaceous earth are the chief mineral fillers. Different forms of some of these minerals are employed; as, for example, silica may be ground quartz, or pumice, or tripoli, the fine rounded grains resulting from the weathering of chert.

Each mineral has properties that make it suitable for certain uses. These properties are color, specific gravity, the nature of the surface, and the shape and, probably of greatest importance, the size of the particles. Most fillers are used essentially as inert substances to occupy space, fill voids, or impart color, but in some lines of manufacture they have an important but not easily understood effect on the physical properties of the finished article. For example, ground barite and marble, aside from their specific gravity, have particles that are much alike in appearance and shape, and yet the

properties they impart to a rubber compound are quite different. Of chief importance in the comparison of fillers from the same mineral, and to a less degree of fillers from different minerals, are the average particle size, the variation in size from maximum to minimum, and the proportionate amounts of the different sizes; the shape of the grain ranks second and applies more especially to the comparison of fillers from different minerals.

Although fillers are used in a great number of industries, the bulk of the material goes into the following products: Paper, wall-paper, prepared roofings, rubber, paint, linoleum, oilcloth, foundry facing, plastic cements, oxychloride cement, artificial stone, polishes and scouring compounds, matches, dressing and dusting powders, various textile products, such as window shade cloth, and phonograph records.

Details of methods of determining the average particle size and proportions of grains of different sizes are given in Technical Paper 296, by W. M. Weigel, mineral technologist, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

BUREAU OF STANDARDS NOTES[1]

Novel Experiment in the Casting of Heavy Clay Ware

The Bureau of Standards recently completed the drying of three experimental pots (outside dimensions $3^1/_2$ feet high by 4 feet 9 inches in diameter, and a maximum wall thickness of 5 inches), designed to be used in the melting of glass. For casting each pot one and one-half tons of slip were required.

The first step in the production of these large pots was the making of the plaster mold in which they were to be cast. Ten tons of plaster of Paris were used in this undertaking, and several problems of interest developed in the course of the work. It was found that a coddle (temporary form) made of battleship linoleum and reinforced with wood slats, which had been used in previous work of this kind, was not sufficiently strong to withstand the hydraulic head of five feet of plaster slip. Special precautions were also required to adequately seal the bottom of the coddle. In addition to this the equipment available necessitated mixing and pouring as many as eight batches of three-hundred pounds of plaster (plus water) each, in the casting of a single section of the mold. Since the various sections had to be turned to the proper shape, the batches of plaster slip had to be retarded progressively so that the entire section would set uniformly. If this had not been done, the bottom part of a section would have set up too hard to be worked with the hand tools employed, while the top layer would still be too soft.

A coddle of sufficient strength was made by using Number 20 gage sheet iron secured by means of small bolts. The bottom of this coddle was sealed by setting it in a groove in the plaster base and filling this groove with plaster, which was allowed to harden before the casting was started. The groove was about one inch wide by one inch deep. After several experiments with an organic retarder it was found that the addition, to every batch of 300 pounds of plaster, of one ounce for every batch remaining to be poured produced the desired time of set. That is, if it was estimated that six batches would be required to cast a certain section, six ounces of retarder would be added

[1] Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

to the first, five to the next, and so on. The mold was cast and turned to shape on a surfacing wheel which is ordinarily used in grinding the faces of special refractory shapes and which, in this case, functioned as a turning wheel or lathe.

The mold was constructed according to designs developed at the Bureau and photographic records were kept of the various stages of the work.

As previously stated, one and one-half tons of slip were required to cast one pot, and no particular difficulty was experienced in this phase of the work, although it was necessary to blunge the slip in four separate batches, keeping the first agitated in an especially adapted mixer until the last was ready for casting. The body composition and deflocculating agent were the same as used in the casting of much smaller shapes, the only departure from the usual procedure being in the greater amount of time required in preparing the slip and the time required for the slip to set up in the mold.

Use of Texas Kaolin in Whiteware Bodies

The Bureau of Standards recently conducted a short investigation in a sample of kaolin taken from a large deposit in Texas. The material was practically pure white in color, very uniform and, as received, was comparatively coarse grained and without plasticity.

Six whiteware bodies, varying in ball clay content from 0 to 14 per cent, and in which the English china clay was replaced in increasing amounts by Texas kaolin, were prepared and made up in the form of test bars, circular discs, and 5-inch plates. These were fired to cones 8 and 10. The test bars were used in determining shrinkage, transverse strength, and absorption, and the discs were used in determining relative resistance to impact. In addition, several shapes were made by the casting process, using slips containing Texas kaolin. The bodies obtained were very high in transverse strength when dried. The fired bodies were of an exceptionally white color, but had a high absorption, and were correspondingly low in transverse strength and resistance to impact. The glaze specimens were very good as regards resistance to crazing. The results as a whole indicated that Texas kaolin could be used satisfactorily in whiteware bodies, but because of the relative coarseness of grains and its high refractoriness, it would require more preliminary grinding than the English clays as well as the use of a larger percentage of ball clay to produce the desired dried and burned structure in the body.

Refractory brick were also made, using the Texas kaolin, both the grog and the bond being composed entirely of this material. The brick required burning at temperatures equal to those used in the production of diaspore and silica brick, but when made in this way the product appeared to be of very good quality.

Circular on Inspection of Portland Cement

With the growing demand for the inspection of structural materials there has been an increase in the number of inquiries received at the Bureau as to proper methods for carrying out the inspection of Portland cement. Much has been written about the inspection of Portland cement, but it appears that there is a real need for a paper dealing more fully with the work from an inspection viewpoint. Based upon the experience of the Bureau in caring for Government purchases of cement, Messrs. John R. Dwyer and Roy N. Young of the cement section have prepared a paper entitled "Inspection of Portland Cement." Often an inspector who is familiar with the various mill processes involved and the routine of inspection is called upon to make a decision which has no precedent in his experience. It is not intended that this paper shall be so far reaching as to be of assistance in all such cases, but during long experience in this work at widely scattered points certain procedures of inspection as outlined have been demonstrated

as being the most effective in avoiding complications and in holding the confidence and respect of all parties to the transaction.

This paper was published as two articles appearing in the August and September 1923 issues of the *Concrete Magazine*. However, to give it wider circulation and to care for the inquiries more promptly the Bureau has prepared it as a mimeograph circular and copies may be obtained upon request. It is hoped that the information it contains will be of assistance in conducting true inspection of cement.

Service Life Tests of Screen Wire Cloth

The Bureau has been requested by the American Society for Testing Materials to take charge of exposure tests on screen wire cloth. The program will include exposure tests of standard No. 16 mesh screen, made of copper, commercial bronze, low brass, aluminum bronze, silicon bronze, and Ambrac metal. It is planned to expose the specimens at four locations; an inland location, an industrial center, on the seacoast in a temperate climate, and on a tropical seacoast. The cloth of each material will be exposed in painted frames capable of withstanding the elements. These frames will be of three types, 12 × 12 inch wood, 30 × 36 inch wood, and 30 × 36 inch metal.

The problem of suitable places for the exposure tests has been taken up with the various coöperating manufacturers, the Bureau of Mines, Bureau of Lighthouses, and the Panama Canal.

Special Refractories for Platinum

Some very satisfactory tests have been made using cast crucibles made from fused zirconia for melting platinum, chromium, and silica. One of the most interesting tests was the fusion of silica sand in a zirconia crucible in the induction furnace. No slagging or erosion of the zirconia by the fused silica could be seen on breaking apart the solidified melt. A cast crucible with walls 2 mm. thick had sufficient strength at 1750°C to hold a 150-gram melt of pure chromium. The walls of the thin crucible were without any outside support during the test.

ANNOUNCEMENT OF THE CUSHMAN GRADUATE FELLOWSHIP IN CHEMISTRY

Western Reserve University

Mr. H. D. Cushman, President of the Ferro Enameling Co. of Cleveland, has established a Graduate Fellowship in Chemistry at Western Reserve University, for the investigation of the gases dissolved in fused silicates.

The holder of the Cushman Graduate Fellowship will receive a stipend of $750.00 and exemption from tuition and laboratory fees which would amount approximately to $250.00. In addition to his research the Fellow will be permitted to pursue advanced courses toward a graduate degree. The requirements for the degree of Master of Arts could be met in one year.

This fellowship is open only to graduates of accredited colleges. Applicants should have a thorough foundation in chemistry and physics, should be experienced in the manipulation of gases, and skilled in the simpler operations of glassblowing. Letters of application must be accompanied by a recent photograph of the applicant, by a transscript of the applicant's undergraduate and graduate record, and by sealed lettres from qualified persons, indicating his character and ability.

Applications to be considered must be received not later than Septembert 6, 1942 Send applications to: The Cushman Graduate Fellowship, Morley Chemical Laboratory, Western Reserve University, Cleveland, Ohio.

ANNOUNCEMENTS OF THE COMMON BRICK MANUFACTURERS ASSOCIATION[1]

A Magazine for Brick

The brick manufacturers are at last given the opportunity to have a national magazine devoted exclusively to the interest of their product. The Directors of the Common Brick Manufacturers' Association, at their mid-summer meeting, approved the plan for the publication by the Association of a monthly magazine. The question of financial support was thoroughly discussed. While funds could be derived from advertising, it was considered that by accepting advertising they would in some measure antagonize existing publications conducted for profit, which now are friendly to us and are liberal to us in the matter of space. The other means of support is to sell subscriptions to the magazine to the brick manufacturers, and this method was decided upon. Every manufacturer may profitably send this publication to a number of architects, engineers, contractors, supply dealers and prospective builders in his own locality, and if the members indicate the coöperation, which we believe they will, the magazine will be an assured fact and will have its first issue out in September. During the coming week a prospectus showing the size and cover design of the magazine will be sent to every member of the organization, and with this a coupon for them to indicate how many subscriptions they will take. The subscription price is $1.00 a year. Every manufacturer should make up a list, from 100 to 500 names, of persons who can be developed as prospective brick buyers, and sent it to the Association. The member will be billed monthly for these subscriptions, and the work of mailing will be done at this office. There will be no expense to the member except to purchase as many subscriptions as he can use at $1.00 a year. We urge prompt response to the circular which will go out during the week.

Machinery Exhibit

In connection with the annual convention of the Common Brick Manufacturers' Association in Chicago the week of February 9, 1925, an innovation will be introduced. Large space has been rented immediately adjoining the convention hall at the Drake Hotel for a comprehensive exposition of clay working machinery and equipment. Response from the machinery manufacturers thus far has been almost unanimously favorable to this enterprise, and the brick manufacturers attending the meeting at Chicago will have an opportunity to meet a great number with whom they do business and witness a display of everything that is new and interesting in machinery and equipment. The exposition is to be made a feature of convention week and the convention sessions so arranged that there will be ample time for thorough study of the exhibits.

GREAT PROGRESS IN STANDARDIZATION SHOWN BY A.E.S.C. REPORT

There now exists the most wide-spread interest and activity in industrial standardization that has ever been shown, according to the new Year Book of the American Engineering Standards Committee.

The work of the Committee is indicative of the growth of the movement as a whole. One hundred and fifty-two projects have been completed, or are under way, and in these various projects two hundred and thirty-five national organizations, technical, industrial, governmental, are officially coöperating through accredited representatives. The

[1] Issued Aug. 9, 1924 by the Common Brick Mfrs. Assn., Cleveland, Ohio.

number of the individuals serving under various sectional committees of the different projects is nearly 1100.

Of the projects which have reached an official status, 31 have to do with civil engineering and the building trades; 25 with mechanical engineering; 15 with electrical engineering; 4 with automotive subjects; 11 with transport; one with ships and their machinery; 14 with ferrous metals; 15 with non-ferrous metals; 12 with chemical subjects; 2 with textiles; 5 with mining; 5 with the wood industry; 1 with the paper and pulp industry; and 11 projects with topics of a miscellaneous or general character.

Coöperation in joint activities between Mr. Hoover's Division of Simplified Practice and the American Engineering Standards Committee has steadily increased. In general the work of the Committee is concentrated upon standardization projects which involve technical considerations, while the Division of Simplified Practice concentrates upon such eliminations as it is possible to carry out from a consideration of statistical production data alone, or as stated in the book on trade association activities issued by the Department of Commerce, "the layman can proceed successfully with a simplification program, while it would be impossible for him to consider seriously standardization problems by himself."

In order to meet the demands made upon it by industry, and to supply the needs of the various working technical standardization committees, the American Engineering Standards Committee has greatly broadened its information services, and has added an Engineer Translator to its staff for this purpose. In this way, complete information is made available to sustaining members, trade and technical associations and other inquirers on standardization activities in foreign countries, as well as in the United States.

The information service is becoming of increasing importance in connection with foreign trade. Exporters are frequently asked to bid on goods to comply with foreign specifications, or in accordance with an unfamiliar trade name or designation, information regarding which they do not have available. Through its information service, the A.E.S.C. has on many occasions supplied copies of standards, or details of information based on a study of foreign standards, in accordance with which bids could be prepared intelligently, thus enabling the American firm to submit its bid by cable, when without such service it would have been unable to act in time.

A new development is the appointment of local representatives of the Committee in four important industrial centers. These are: K. F. Treschow, Secretary, Engineers Society of Western Pennsylvania, Pittsburgh; J. B. Babcock, Executive Secretary, Affiliated Societies of Boston, Boston; Edgar S. Nethercut, Secretary, Western Society of Engineers, Chicago; Professor George S. Wilson, Engineering Experiment Station, University of Washington, Seattle.

One of the most striking developments of the standardization movement is the increasingly important role which trade associations are playing in it. More than 140 national trade associations are officially participating in standardization projects under the auspices of the American Engineering Standards Committee. That standardization is a legitimate and constructive activity for associations is everywhere recognized, and explicitly so by a recent decree of the U. S. District Court at Columbus, Ohio.

Standardization, being essentially a coöperative undertaking, must necessarily be predicated upon some form of organization. To carry out a piece of standardization work throughout an industry, it is practically essential that there be some form of organization covering this particular industry, even though it be a loose-knit one. More and more trade associations, no matter for what purpose they may have originally been organized are going into technical work, and it is natural if not inevitable, that both trade and technical associations should eventually concern themselves to an in-

creasing extent with standardization activities. This tendency is becoming more marked on every hand.

The Year Book may be secured by addressing the American Engineering Standards Committee, 29 West 39th Street, New York City.

TEN MILLION DOLLAR CAMPAIGN[1]

The National Museum of Engineering and Industry announces its campaign for $10,000,000.

One million dollars has been assured towards the establishment of the National Museum of Engineering and Industry, Incorporated, with headquarters in the Engineering Societies Building. A campaign to raise an additional nine million dollars starts today. The president of the new organization is Dr. Elihu Thomson who today receives the Kelvin Gold Medal from the Royal Society at the Kelvin Centenary in London. The Vice Presidents are Dr. Edward G. Acheson, one of the creators of the modern abrasive industry, Dr. Leo H. Baekeland, inventor of Velox paper and Bakelite, he is President of the American Chemical Society, and Dr. Edward Weston, creator of the Weston type of electrical instruments. Its Trustees are Mr. Philip T. Dodge, Chairman of the International Paper Company, Mr. Howard Elliott, Chairman of the Northern Pacific Railroad, Dr. Ira N. Hollisk, President of the Worcester Polytechnic Institute, Dr. Elmer A. Sperry, President of the Sperry Gyroscope Company, and Mr. Worcester R. Warner, of Warner & Swasey, Cleveland, Ohio, makers of the great telescopes of the world. Mr. George E. Roberts, Vice President of the National City Bank, is Treasurer, and Mr. H. F. J. Porter, Industrial Engineer, is Secretary.

In coöperation with the Smithsonian Institution the new organization is planning to erect on its grounds in Washington a building to house the original models of early inventions and the records of constructive achievement of pioneers, inventors, and engineers in the development of transportation and industry. In this way the United States will be given the kind of institution which all the great European nations have possessed for years, and in the layout of the proposed museum use will be made of the data collected by an expert who has recently returned from a year's survey of museum practice abroad.

An important departure in the American scheme is proposed however, made necessary by the vastness of the country. In addition to the central collection at Washington special collections such as replicas of the historical exhibits will be carried to the people, also live machinery of modern processes will be placed in affiliated museums in industrial centers of every state.

Already old models and records long forgotten have been located and resurrected and this winter will be exhibited at the headquarters as a demonstration of how the ultimate collection will appear.

Incorporation was effected in March last under the laws of the District of Columbia by the "Organizing Committee of 100" composed of chairmen of boards of directors, presidents and chief engineers of industries and railroads, and professors of engineering and history in universities and colleges.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING

Over 260 exhibitors have been assigned space at the Third National Exposition of Power & Mechanical Engineering which will be held in the Grand Central Palace, New

[1] Natl. Museum of Eng. and Industry, 29 W. 39th St., N. Y. City, July 10, 1924.

York City, from December 1 through December 6. As this number is more than two times greater than those who had engaged space on August first a year ago, the indications are that the coming event will be of tremendous interest and importance.

The 1923 Exposition drew an attendance of 62,079 engineers, executives, financiers, operating men, as well as large numbers of engineering students with their instructors. This is an increase of 15,000 over the number who attended the 1922 Exposition.

As the expressions of appreciation and interest in the 1923 exhibit were proof of the value of the Exposition and as the large attendance of vitally interested visitors was a great satisfaction to those exhibiting, it is safe to assume that the coming event will greatly surpass all of its predecessors. The constant growth of the Exposition is interesting proof that the industries related to power and mechanical engineering are in a state of rapid development, and need the inspiration and ideas started at the Exposition. The growth of the Exposition has also been an object lesson to these industries, for in addition to giving the engineering and general public an idea of the size and importance of the industries, it has dignified the industries in the eyes of those engaged in them and presented a perspective of functions and methods that nothing else could have provided.

The Exposition will, as usual, parallel the meetings of The American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. The A.S.M.E. meeting will be held in the Engineering Societies Building, 29 West 39th St., New York City, and the A.S.R.E. meeting will be held at the Hotel Astor, New York City. Plans are under way for the American Society of Heating and Ventilating Engineers to have a gathering of Local Sections during the time of the Exposition. The coöperation of the various engineering societies has been valuable, since it enables members to attend the meetings and at the same time see the interesting exhibits at the Grand Central Palace.

The management of the Exposition is assisted by an Advisory Committee of designing and operating engineers. For the coming Exposition this Advisory Committee has been augmented by George A. Horne of New York, President of A.S.R.E.; Homer Addams of New York, President of the A.S.H.V.E., and John H. Lawrence of New York. Mr. Lawrence served on the Committee the preceding year during his term as Chairman of the Power Division of the A.S.M.E.

The American Society of Mechanical Engineers, the National Electric Light Association and the National Association of Stationary Engineers are already represented on the Advisory Committee by their officers. The A.S.M.E. delegation consists of the President, Fred R. Low; Chairman of the Professional Divisions Committee, James Partington; Chairman of the Power Division, Nevin E. Funk; and the Secretary Calvin W. Rice. The N.E.L.A. is represented by the President, Walter H. Johnson, and the N.A.S.E. by Past-President, Fred Felderman. The balance of the Advisory Committee who hold over from year to year are I. E. Moultrop, Chairman, of Boston; W. L. Abbott, Chicago; N. A. Carle, Newark, N. J.; C. F. Hirshfeld, Detroit; O. P. Hood, Washington, D. C.; E. B. Katte, New York; David Moffat Myers, New York; and Fred W. Payne and Charles F. Roth, managers of the Exposition, with offices in the Grand Central Palace.

MANAGEMENT WEEK—OCT. 20-25

Management hits all branches of endeavor. Sixty-five cities are holding meetings on the same subject is somewhat unique even in this land of the unusual. Five national societies are sponsoring these activities—*i. e.*,

American Management Association
American Society of Mechanical Engineers
National Association of Cost Accountants
Society of Industrial Engineers
Taylor Society.

Should you desire specific information at any time regarding Management Week, it will be promptly given by Ernest Hartford, 25–33 West 39th St., New York, N. Y.

An official representative of each Society has been appointed to serve on a national committee on arrangements. The personnel of this Committee is as follows: Henry Bruere, the representative of the American Management Association; Sterling H. Bunnell, representing the American Society of Mechanical Engineers; W. H. Leffingwell, representing the Taylor Society; E. M. Robinson, representing the Society of Industrial Engineers, and C. R. Stevenson, representing the National Association of Cost Accountants. At the organization meeting, C. R. Stevenson was elected permanent chairman of the Committee and Ernest Hartford secretary. It is the wish of the Committee that all correspondence be directed to its secretary at the Engineering Societies' Building, 25–33 West 39th Street, New York.

To Secure Aid of Local Clubs

At present the Committee is engaged in compiling a list of the cities where there are local organizations of any of the five national societies. It is proposed to hold meetings at each of these places and to appoint as local committees the chairman or president of the local branches of the national society. Where there is no local branch, the national society will designate one of its members residing in the community to serve on the committee. These local committees, in addition to having charge of all arrangements for their local meetings, will also be encouraged to secure the interest of local civic organizations, such as the Rotary Club, Kiwanis Club, Lions Club, Chamber of Commerce, etc. The plan is to have each of these civic organizations devote its meeting during the week of October 20 to a subject on some phase of management. The keynote of the meetings this year will be Budgeting for Better Management.

The National Committee is developing a publicity bureau from which will be disseminated fortnightly the latest announcements in the development of the general plan. The Committee will also issue bulletins bi-weekly to the various sub-committees throughout the country.

The Committee will be glad to receive suggestions and constructive criticism from anybody having ideas on the subject and will also welcome the receipt of contributions from authors or suggestions of desirable speakers who may be interested in presenting papers during Management Week.

AMERICAN INSTITUTE TO HOLD BIG EXPOSITION OF INVENTIONS

Manufacturers in every American industry will be interested in the Exposition of Inventions to be held, December 8 to 13 inclusive, 1924, in the famous Engineering Societies Building, New York City. The American Institute of the City of New York is handling this display through its Inventors' Section, with behind it an experience of ninety-six years in fostering and portraying American industrial life.

A feature of the Exposition will be exhibits from the leading American industries showing developments of various machines, utilities and processing methods. In all

fields the ingenuity of the inventor and the part he has played in the progress of America will be emphasized.

In this display of American inventions the American Institute will be continuing with a new emphasis almost a century's encouragement of inventors and introduction of their works to the public. Among inventions now used throughout the world that were first displayed to the public at earlier All-American fairs of the Institute are the Morse telegraph, the Hoe lightening printing press, the McComick reaper, the Howe sewing machine, the Bell telephone, the Colt revolver, the Francis metallic life boat, and many others.

The American Institute also established the first permanent exhibit—an idea later adopted in various industries—where "machines, models, specimens and drawings" were displayed to the public. Great annual fairs of the Institute, begun in 1828 and held at such widely known places in their times as Niblo's Garden, Castle Garden, Crystal Palace, Palace Garden, the Academy of Music and Madison Square Garden, in New York City, portrayed year after year the advancements in agriculture, commerce, manufactures, science and the arts until, with the expansion of the country's business in the last quarter century, the idea developed into the more famous world fairs and national and international industrial expositions under various auspices and managements.

Arrangements for the display of working models or actual devices at the Exposition of Inventions can be arranged through a Committee of the American Institute at 47 West 34th Street, New York City. All proposed displays are subject to approval by the Institute, it being the desire to show only those things of sound worth.

ANNOUNCEMENT OF CHEMICAL EXPOSITION DATE

There will be no Exposition of Chemical Industries in 1924. The next Exposition of Chemical Industries will be held September 28 to October 3, 1925, at the Grand Central Palace, New York.

"This Exposition will not be held in the United States prior to September, 1925," states the announcement of the management. As a result of a vote of exhibitors, taken last year, the decision was definitely reached at that time not to hold the exposition in 1924, but to skip a year and hold the next one in 1925.

At the meeting in 1923, where time and place for the next Chemical Exposition were discussed and decided upon, the exhibitors decided by a large majority to hold all future expositions in New York, and selected the Grand Central Palace for 1925.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	Oct. 6–7, 1924	Los Angeles, Calif., Hotel Biltmore
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924—Jan. 3, 1925	Washington, D. C.
Am. Assn. of Museums	1925	St. Louis, Mo.
Am. Assn. Flint and Lime Glass Mfrs. (Quarterly Meeting)	Oct., 1924	Pittsburgh, Pa.

Am. Assn. Flint and Lime Glass Mfrs. (Annual Meeting)		Atlantic City, N. J.
Am. Chemical Meeting	Sept. 8–13, 1924	Ithaca, N. Y.
Am. Concrete Inst.	Feb. 24–27, 1925	Chicago, Ill.
Am. Electrochemical Society	Oct. 2–4, 1924	Detroit, Mich.
Am. Engineering Council (Administrative Board)	Oct. 17–18, 1924	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
Am. Foundrymen's Assn.	Oct. 11–16, 1924	Milwaukee, Wis.
Am. Gas Assn.	Oct. 13–17, 1924	Atlantic City, N. J.
Am. Inst. of Architects	1926	Atlanta, Ga.
Am. Inst. Min. & Met. Engineers	Oct. 13–15, 1924	Birmingham, Ala.
Am. Mining Congress	Sept. 29–Oct. 4, 1924	Sacramento, Calif.
Am. Soc. of Mechanical Engineers	Dec. 1–4, 1924	New York City
Am. Soc. for Steel Treating	Sept. 22–26, 1924	Boston, Mass.
Am. Zinc Institute, Inc.	1925	St. Louis, Mo.
Assn. Iron and Steel Electrical Engrs.	Sept. 15–19, 1924	Pittsburgh, Pa.
Common Brick Mfrs. Assn. of Am.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Exposition of Inventions	Dec. 8–13, 1924	New York City
Franklin Inst. Centennial	Sept. 17–19, 1924	Philadelphia, Pa.
Grinding Wheel Mfrs. Assn. of U. S. and Canada	Sept. 12	Pike, N. H.
The Gypsum Industries	Sept. 23–24, 1924	Chicago, Ill.
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Management Week (Auspices of Am. Soc. of Mech. Engrs.)	Oct. 20–25, 1924	New York City
Natl. Academy of Sciences (Joint Meeting) Harvard Univ. and Am. Acad. of Arts and Sci.	Nov. 11–12, 1924	Boston, Mass.
Natl. Assn. Brass Mfrs.	Sept. 17–18, 1924	Cleveland, Ohio
Natl. Assn. of Mfrs.	May, 1925	N. Y. City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Glass Distributors Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Paving Brick Assn.	Dec., 1924 or Jan., 1925	
Natl. Safety Council	Sept. 29–Oct. 3, 1924	Louisville, Ky.
N. J. Clayworkers Assn. and E. Sect. of the Amer. Ceram. Soc.	Dec., 1924	New Brunswick, N. J.
Refractories Mfrs. Assn.	Oct. 3, 1924	Pittsburgh, Pa.
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Assn.	Jan., 1925	Kansas City, Mo.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Vol. 3 October, 1924 No. 10

EDITORIALS

WHAT BENEFIT DO YOU DERIVE FROM ANNUAL MEETINGS?

The annual meetings of this Society are for the purpose of collective consideration of technical and scientific problems, theories and facts. Much of this is accomplished in an orderly way through scheduled papers and discussions. It is the formal programs that make our meetings definite in results and effective in purpose. Programs are essential.

But by no means are all the benefits of these meetings derived from the formal programs. The closest confidences and best exchanges are in the "button-hole chats" and the private room "round-up." A meeting without these informal "get togethers" of a few kindred spirits would be lacking in much of the personal inspiration for which the annual meetings of this Society are noted.

The success of these annual meetings is dependent upon a hearty coöperation of many. It does not rest entirely upon the two hundred persons who contribute the papers. An interested audience is essential. Participation in the discussion with citations of observations and recitation of theories by several hundred persons is essential. All of these together are necessary to an informing and inspiring meeting, but the first essential is the program of papers.

The provision of an instructive program of papers should be a matter of concern to every member of the Society and to every firm represented.

The value of these meetings and of the *Journal* is dependent on the papers. It should be remembered that these are mutual enterprises in which each has an obligation as well as an opportunity.

It is very human for plant executives to withhold from publication the results of observations and investigations. Especially is this so if these investigations have been costly and if the results are directly responsible for a better product or lessening the cost of manufacturing. This editorial is not a criticism of this attitude and action of plant executives, but is prompted by the belief that the plant executives are thus withholding more from themselves than they are from their competitors.

In the first place, a coöperative enterprise like this SOCIETY cannot be effective without coöperation. Each must do his share. Each must contribute to the general fund of information.

And second, there is no person, or manufacturing organization which does not continually profit from the published findings of others. The more progressive and prospering manufacturers believe it to their advantage to stimulate the searching for and the publishing of facts relating to their peculiar problems by reporting some of their own findings. The non-industrial investigators are anxious for the problems known to be of industrial value. A reported research almost always causes a widespread research activity on that problem.

In the third place, successful manufacturing depends more on the knack of application than upon the knowledge of the principles and methods involved. Where manufacturers of like wares exchange information most freely concerning their methods and mixtures they continue with the same differences in manufacturing methods and have suffered no loss through increased competition. On the other hand, manufacturers of like products have benefited through free exchange of information and have maintained their usual margin of profit. They have raised the standard of their product and increased their markets. It is the experience of all groups who have thus coöperated intimately that each has profited, none has lost and the satisfaction derived from a better product at a lower cost has made coöperation worth while. Every manufacturing organization has more to gain than to lose through participation in the meeting programs and through publishing in the *Journal*. The gain comes from the exchanging with the others and from the stimulation which is thus afforded to the many university and bureau investigators. It would be an indication of an unproductive technical staff if there were no investigations which have only an indirect bearing on the product or on the special methods employed. Reports of results of such investigations are of value as general information. They constitute the instructive meeting programs and make the *Journal* valuable.

Withholding from participation in these programs is in fact withholding

much from self. Each person and each company would profit directly through participation in these annual meeting programs.

THE ECONOMIES IN JOINT CERAMIC RESEARCH

The unanimity of approval for an institute for ceramic research by the trade press expresses opinions of all those who have "thought this question through." That the ceramic manufacturers should be federated for the purpose of solving their common problems is no longer doubted. R. D. Landrum, president of the AMERICAN CERAMIC SOCIETY, has gone a step further in his suggestion that since it is deemed profitable for trade associations representing manufacturers of heavy clay products to organize into a separate institute, similar institutes of each group of ceramic products should be formed and all federated under a joint advisory and fundamental research directorate. There is enough in common in many of the problems and in the fundamental principles involved, to warrant such a federation. The success of this SOCIETY in federating these separate interests assumed by some to be diverse and too much unlike, is proof of the feasibility and of the economy of a ceramic research institute which in fact would be a federation of all ceramic manufacturers through their respective trade associations and institutes.

Our first recommended economy in ceramic research was that of a Ceramic Institute. The heavy clay products group of trade associations has already begun organizing their institute to be known, probably, as the Clay Products Institute. The whitewares manufacturers could with equal profit organize a ceramic Whitewares Institute and the glass manufacturers, a Glass Institute, each being a federation of trade associations.

President Landrum's economy recommendation is that these several group institutes should be federated into a general Ceramic Institute. The officers, libraries and personnel could thus be together on an orderly coöperative basis. This would reduce overhead costs and increase the productiveness of each.

Our third economy recommendation is one which is already favorably considered by the heavy clay products group; that of employing the research facilities already available in the federal state and endowed educational and research institutions, rather than setting up a laboratory owned and operated exclusively by ceramic manufacturers.

Other economies which will be had in scientific and technical research through a federation of the several groups, readily suggest themselves. Most of these are economies in the related problems and in the fundamentals common to all. Of large additional value return to the ceramic manufacturers would be the increa[illegible] research activity in silicate chem-

istry and physics which would surely follow from the massed influence of a general federation of all the group institutes through a common head, the American Ceramic Institute.

There is power and economy in coöperation. A central research promotion and advisement with decentralized interest and support through each distinct group provides for the maximum force and economy to be had through coöperation and for the direct and personal problems of each group. This scheme of decentralized activities through a central coördinating head is the scheme of organization of the AMERICAN CERAMIC SOCIETY Each of the seven Divisions is self-constituted and managed but all are coördinated through the central organization. This provides for the maximum freedom to each Division to develop and to do for its constituents, and for the large economies and increased forcefulness to be had through coördination.

We continue our promotion of ultimately having an American Ceramic Institute in which each group will participate for its common good and the maximum economies. We believe this to be vital. Not until this federation of all the separate groups shall have been accomplished will ceramic science and technology be most economically and surely progressed. A centralized collaboration with decentralized special interests will be most impressive alike to fundamental investigators and the plant technologists. Thus each industrial group would have its special purposes served in the manner it shall decide and at the same time profit through the centralized or combined recording, searching and promoting agency.

This is real economy in the "reduced overhead expenses" and in the "increased overhead efficiency" obtained through coördination and collaboration. President Landrum's proposal is the best and most forward reaching proposition yet made. We continue our boosting for an American Ceramic Institute.

PAPERS AND DISCUSSIONS

DISCUSSION ON PLASTICITY[1]

By E. C. Bingham

Dr. Bingham: I have been greatly interested to have Mr. Cooke tell of the work which he has been doing. I had no thought of addressing you on the subject of plasticity myself although I shall be glad to attempt to answer any questions which may be raised.

The main thought that has grown from our work is of the illusory character of viscosity measurements when applied to suspensions and emulsions. The "viscosity" means practically nothing when the shearing conditions are not stipulated. Plasticity is a complex property made up of at least two variables and, therefore, it is highly improper to identify viscosity with plasticity or in any other way attempt to represent the plasticity as a simple property.

I have tried to find some way in which one can relate to each other *yield value* and *mobility*, but I believe that they are independent variables, which together make up plasticity. In suspensions of clays in water, for example, it may be possible by changing the concentration to obtain identical yield values, but they will not have identical mobilities and *vice versa*.

Plasticity is, therefore, a loose term which may continue to be used just as heretofore, and when it is to be given quantitative meaning this must be done in terms of yield value and mobility.

Mr. Cooke: I would suggest that Dr. Bingham tell us a little more about the properties of plastic substances that he has worked, on the concentration of zero yield value and the concentration of zero mobility and their interpretation.

Dr. Bingham: If the yield value and mobility are fundamental properties of solids which may be measured with precision, I think that the interpretation of these properties for a given industry will follow as a matter of course. How it will work out in the ceramic industry I do not know, although I may offer the following suggestion from our work on paints. We utilized paints for study largely because the dispersion medium, linseed oil, is non-volatile. Lithopone seemed suitable as a disperse phase. In Fig. 1 are shown the mobilities and yield values plotted against the weight concentration. Starting with the fluidity of linseed oil, the mobility is constantly lowered as the pigment is added to oil, until finally the mobility reaches a zero value.

If the mobility concentration curve is linear, it is only necessary to know the fluidity of the oil and the mobility of one concentration of paint in order to calculate the mobility of any mixture. We can also calculate

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Enamel Division)

the concentration of zero mobility, point D in the figure, where close packing takes place.

It is apparent that beyond the concentration of zero mobility any shear must be of a different character, since there is no longer sufficient dispersion means to fill the pore spaces.

The yield value also increases with the concentration and this increase over a considerable range appears to be a linear function of the concentration. The concentration of zero yield value A is where there is the transition from viscous liquid to plastic solid. The point of zero yield value is probably dependent on the size of the particle. This concen-

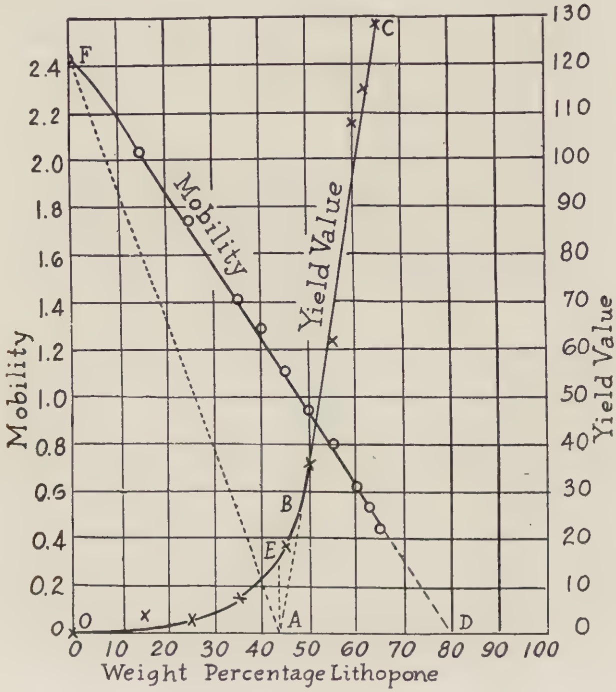


FIG. 1.

tration is of importance as an indication of the adhesion between the pigment and the oil or between the particles of the disperse phase. The yield value-concentration curve is not linear at low concentrations for some reason which is not yet understood, so that the yield value-concentration curve $B\ E\ O$ bends off toward the origin. These yield values are small but they must be taken into consideration. Below the concentration of zero yield value the flow may be spoken of as *pseudo-plastic*.

MR. SWEELY: Mr. Chairman, a question has occurred to me on this. Very often with an enamel which is a clay suspension carrying quite a

large quantity of powdered glass, we have this condition, that the enamel, we will say, runs. And in order to correct that we will add a flocculating medium such as magnesium salts or something of that kind to correct that condition. And the addition of that salt will very often result, if an excess is added, in the enamel becoming quite stiff. Now the quantity of water present will affect the amount of flocculating agent of medium necessary to stop the enamel running. In other words, a very small amount of flocculating medium or what we call a rather dry solution (that is where the water content is low) will bring about exactly the same effect as if the solution was high in water and we had a rather large amount of flocculating medium.

I was wondering how that would work. For instance, in the manipulation of our enamels if we were dipping enamel with high content of water we would have a rather large amount of magnesium sulphate to set the enamel up. Obviously we would not get as much glass onto the piece of ware (and that is the thing we are after) as we would where the enamel is dry and the flocculating medium is added.

Dr. Bingham: The fact that the enamel becomes stiff on adding magnesium salts indicates that there is a large increase in yield value. It is quite possible that the mobility is changed but little.

Thus in a lithopone suspension made up in mineral oil Jacques found that 0.2% of oleic acid lowered the yield value 80%, without affecting the mobility.

It is highly desirable that some one take a series of clays or enamels of different plasticities as measured by practical tests and determine how great a correlation there may be with the yield value or mobility or both.

In paints it was found that most paints are made up to have the same yield value without any regard for the mobility. In these enamels the opposite *may* be true. The clay is added, if I am correctly informed, so that the enamel will stay on the ware which would indicate that a high yield value is desired. Possibly the mobility is of little or no moment in this work. Exact measurements alone can answer.

Mr. Poste: It was mentioned that one of the problems in connection with flat surfaces was apparently this very one. I am wondering if it would be too much to hope for a curve of yield point versus mobility for a given type of work, establishing a proper curve and then feeling reasonably sure that if you get a combination of water content and setting up (as Mr. Sweely has spoken of) that that will bring your relation of yield point to mobility on a predetermined point or curve, thus giving reasonable assurance of good working qualities. It seems to me that that would be possible on a thing that is standardized like the table top industry.

Dr. Bingham: In our investigation of paints we tried to establish some relation between the yield value and mobility. As stated, what we found

was that in general the yield value fluctuated within a very narrow range. If in enamels the yield value must also have a certain value, either by the use of flocculating agents or otherwise, the solution of the problem will be simpler than is suggested by Mr. Poste.

If on the other hand the yield value and mobility are both to be specified, it is quite possible to specify the arbitrary limits for each one. I am inclined to believe that the yield value is the important thing in enamels as in paint, because the yield value is necessary to hold the enamel on the ware.

CHAIRMAN STALEY: That is what I understand. The yield value is the deciding factor and the mobility may go up or down as it may, but it has no effect on the dipping qualities of the enamel.

DR. BINGHAM: That may be the case.

MR. LINDEMANN: In dipping paints, especially in panning, I notice that the painters use hydrometer tests almost exclusively. I have been wondering whether that test was a correct one for them to use, and also whether the hydrometer test would give an indication of our enamels.

DR. BINGHAM: The hydrometer gives the specific gravity from which the concentration can be calculated from the specific gravities of the components. If the plasticity curves of Fig. 1 were known by preliminary investigation of the materials, it is obvious that a determination of the specific gravity would be sufficient to fix the yield value and mobility. But unless the degree of flocculation is always the same and the particle size obtained on grinding as well, one could not depend on being able to calculate the yield value and mobility from curves as in Fig. 1.

MR. LINDEMANN: The reason I am bringing that out is that practically all the japanners have used that for years. When they buy japan it is pretty thick and they thin it down with benzine. If it is too thin, they will put a little more japan in until they get the same hydrometer reading that they have used before. And they seem to have successful results. It may not be correct but it does the work.

CHAIRMAN STALEY: I may say that our use of hydrometer readings in connection with the work of enamel slips has not proven satisfactory.

MR. SWEELY: That has been my experience also. The hydrometer would enable us to predict the yield value and mobility in an enamel if we did not flocculate the clay. It is the flocculation of the clay that interferes with the use of specific gravity. I have tried repeatedly to standardize enamel by taking specific gravity of the enamel slip. But as soon as you add a flocculating agent the whole series of specific gravity tests are upset.

H. D. CUSHMAN: I would like to ask Dr. Bingham whether there is an apparatus in existence which would enable the enameler to quickly determine the status of his enamel. We have been trying for about a

year to develop an apparatus that would give us a certain fluidity. If a man could quickly determine in the plant whether his ground coat was in proper status, that would be a good thing.

DR. BINGHAM: Mr. Cooke has obtained very good results with his very simple apparatus. Possibly that is not quick enough. We have been experimenting at Lafayette on measuring the time required to fill different portions of a long capillary tube under a constant pressure. A plasticity measurement can be completed in a few minutes and a fluidity can be measured in a few seconds. But no effort has been made to adapt the instrument for plant use. Eimer and Amend are selling a plastometer but it is not as simple or quick to use as the forms described above.

MR. CUSHMAN: Will the fineness of grinding have a very changeable effect on that apparatus?

DR. BINGHAM: Fineness of grinding as well as flocculation have a very great effect on plasticity. But I believe that the apparatus can be used with a considerable range of particle sizes. The material should be screened to take out coarse extraneous material.

CHAIRMAN STALEY: Enamels are ground sometimes to pass a sixty-mesh sieve and sometimes to pass a two hundred-mesh sieve, although the concentration by weight is the same.

With any diagram or standard such as Mr. Poste has suggested, the fineness of grinding should be specified as well as the concentration.

MR. TYLER: A very important factor in the matter is to find some way to stabilize enamels in the slushing pan. I think if the matter of grinding were given serious consideration in its relation to the fineness of the enamel we would get an answer to this question. We all know that an enamel changes as soon as it is put into the slushing box and that there are no two hours in the day when it is absolutely the same, unless it is being worked with all of the time.

Insofar as paints and enamels are concerned, I think that they are entirely different. You can no more measure them together through the same meter than you can oil and water together.

THE TRANSLATION OF PYROMETRIC CONES TO TEMPERATURES[1]

MR. BOOZE: I asked to have this discussion given on the floor not because I had anything to give, but because I hoped to get something out of it. The refractories manufacturers are concerned in the use of cones, not only in firing their ware but in testing it. The cones are used very differently in those two respects. In the first place, they want to control

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Refractories Division).

the heat in their kiln, and that brings up the same problem they have in the other Divisions. With respect to the test for softening point, there is no criticism whatever of the standard cones. The problem is in the correct utilization of the results obtained. Many manufacturers insist on using the fusion point as corresponding to the temperature that their brick will stand in an industrial furnace. We know that that is not true and I doubt if we can ever use the fusion point in that way. It might be possible to determine in a test of long duration where a brick did soften enough to flow and use that data in the manner described. However, this would complicate the test considerably and some data that I have indicate that even the present test requires more careful supervision than is ordinarily given it.

Five samples were sent to each of four different laboratories for fusion point determinations, considerable care being exercised in preparing the samples so that one lot was, to all practical purposes, identical with each of the others. Each of the laboratories to which the samples were sent was experienced in making this test, so that the results obtained may be considered as being representative. On the first sample the fusion point reported varied from cone 32 to cone 33, the second from cone 30 to 33, the third from cone $28^1/_2$ to 30, the fourth from cone 26 to 27 and the fifth from cone 29 to 31. These differences are considerable and while I do not doubt but that each laboratory would be able to check its own results, it is evident that either the test is not sufficiently well defined or that the fusion point cannot be accurately determined within limits of less than two cones. We have found in our laboratory that we can check this determination within a half cone in nearly all cases and for this reason I feel that the methods used in conducting the tests were responsible for the differences noted, but until the conditions are satisfactorily standardized, the inaccuracy of the test should be recognized and proper allowance made either in interpretation of results or in fusion point limits written into specifications.

I understand that the Bureau of Standards contemplates an investigation whose purpose is the determination of the time-temperature relation for the softening point of standard cones. It would be advisable for them to determine and publish an accurate temperature scale for the softening point of the standard cones when the test is carried out at the heating rate specified in our standard methods for tests. There are two temperature scales in use now, neither of which is accurate and which differ considerably. It is rather common practice for manufacturers to give the fusion point of their product in degrees rather than in cones, the temperature being obtained by them by reference to a table after the fusion point had been determined in cones. The temperature which is assigned varies according to the scale used. For this reason a standard scale is necessary in

spite of the fact that the fusion point temperature is accurate only for the prescribed rate of heating.

GENERAL ORTON: I think that Mr. Booze has well pointed out the fact that to use a cone as a guide in burning clay ware is one thing and to use it as a mode of determining the ultimate fusion point of a ceramic mixture with a view to attaching a temperature tag to the test is quite a different thing. You are all ceramists and chemists and you will know that inherently the fusion point of the mixture of dissimilar minerals cannot be made a very accurate determination of temperature because so many factors enter into it; the size of grain of the mineral, the way in which they react on each other, and firing conditions, all mitigate against exactitude in the process of the solution of one mineral in another. That, after all, is what the softening and bending of a cone means, gradual solution of the minerals in it until the mass becomes more like a fluid than a solid, and bends.

From my own standpoint and after some twenty-seven years of contact with making cones I feel an increasing regret that Dr. Seger in starting this work ever attached the idea of temperature to the use of his cones. I think it would be much better and we should have been farther along perhaps in our appreciation of the case if he had not done so. But the mischief is done; the cone stands before the world in some degree as a mode of measuring temperature and it is too late for us to attempt to get rid of that impression.

I have in all my pronouncements on this subject, advertising matter, and private correspondence, always minimized the temperature idea as much as possible and frankly called attention to the defects of the cone or any similar material as a time-temperature proposition and not temperature alone. I was rather amused and a little chagrined recently to find out that because I had taken that ground so frankly in what I have printed and circulated on the subject that some of the public are interpreting that as a disclaimer of the quality of my material product and imagine that the other is all right. I hardly like to have that inference made.

In the firing of ceramic ware the cones are used as a guide. You are submitting the ware to a comparison against a material in which a similar series of reactions is in process. If you are firing fire brick the grain is coarse and the mineral combinations are slow, but after all it is a process of gradual solution or hardening caused by the solution of one mineral in another and that is what the cone is doing. So that it seems to me to be possible to establish a relationship between the cone where long firing processes are concerned and the slow reaction time is made use of and the similar degree of hardness or stability in the body that you are trying to fire.

It does not mean to say the correct firing temperature in the kiln and the melting point of the cone have any other than a fortuitous relation

to each other but if you find, for instance, that cone 16 gives you a time-temperature treatment at the end of which the fire brick show good physical qualities you will not need to establish any other connection. For that purpose I think the cones serve as well as they do in whiteware or any other.

When you make a fusion test the situation is quite different. The fusion test of a fire brick is a different thing entirely from its actual use. Actual use is strung out over long periods of time usually from a few days to many months and the time factor is more extended perhaps than in any similar case we could illustrate. But when you are determining the fusion point of fire brick you destroy all of that set of conditions. You pulverize the fire brick to a minute powder, prepare a test piece, put it into a small furnace and bring the temperature up rapidly to the point of ultimate softening. Now the cone is doing the same thing and it is possible therefore to establish a fairly exact relationship between the melting of the cone and the melting of this ground pulverized mixture composing the fire brick.

The information thus obtained does not mean that the fire brick could be used at that temperature. The information we have is an arbitrary thing and not very directly translatable into service temperatures of the product. But the trade, I imagine, demands that there be some idea of relative fusibility of fire brick and therefore, to meet that, this test has been devised by fire brick makers and users to get at something to show that one fire brick will actually fuse at a different temperature than another fire brick though neither one of them is actually used at their fusing temperatures; or that the fusing conditions if obtained at all are attained in the long-time reaction, in which the time factor is almost infinite.

I indicated in the early part of my statement that it is unfortunate that the temperature idea is so insistently connected with the use of cones but since it is, the only logical thing to do so far as applying the cone method to the determination of the fusing point of refractory materials and probably to other purposes is to establish under accurately controlled conditions by the best methods available the fusing point of the cone mixture. But you will, of course, understand that if that is done it has to be hedged about with a very exact set of specifications. The cone itself must conform accurately to the size of the crucible in which it is fired, must conform accurately to size, and the wall of the crucible must be just so; the opportunities of radiation of heat by which it is surrounded must be so; the time factors must be accurately controlled both in the preparatory stage of the firing and later. The rate of temperature increase per hour or minute must be known. All of these things have to be done if you are going to tie a temperature tag on the cone. If all these things are done I believe that you will find that the fusing point of the cone can be stated quite accurately and that the cones will come down at that exact temperature.

But that does not mean that somebody else who has not that series of equipment and who is willing to devote that amount of time to the process would get the cone fusion at that temperature.

Of course, the application of the temperature to fusion of refractory cones is somewhat more difficult than it is in a lower series because of the pyrometic difficulties themselves; the various points beyond which you can distinguish with the naked eye what is going on. That is much more difficult.

I do not wish to give you the impression that I think this test should not be made. On the contrary, talking with a number of you I have rather been switched to the point of view that some good results and some educational may be had by going into it. I think those who clamor for the use of temperatures in connection with cones will perhaps gain a truer perspective of the whole subject of accurate comparison being made. It will show how many factors are not now appreciated.

I take the cone somewhat seriously, not as a scientific tool, but as a great practical convenience. There can be scarcely any doubt of that in view of the constant increase in the use of it over a long period of years. Twenty-seven years is quite a while. The curve of use has gone steadily onward all the entire period and does not seem to show any indication of stopping. That could hardly be unless people got a definite value out of it. But the greatest value will be gotten out of it if we realize in the beginning just exactly what it is for and try to use it for that purpose.

In connection with the Bureau of Standards I will coöperate, if allowed, with that organization or with any other organization that the AMERICAN CERAMIC SOCIETY wants to utilize in having tests made to show the relation existing between the foreign-made cones and the American-made cones. I am perfectly willing to facilitate that by furnishing materials and advice so that we can establish as nearly as possible the relationship between the different series. I am not very optimistic about any great concrete value coming from such tests. I think you ought to look the facts in the face and use the cone for what it is good for and not attempt to make it do things for which it was not designed.

MR. HOWE: I have felt for some time too, we are well in need of some educational work in connection with the use of cones. In fact the AMERICAN CERAMIC SOCIETY on one or two occasions sent small mimeographed copies explaining the strong points and weaknesses of the cones. In the refractories industry more than probably any other, the cones are used to a large degree in the sale of products as well as in the manufacture. We find as we get up to the higher temperatures the published fusion point varies considerably. They agree pretty closely to cone 20, but the old series carries the 20°C jump whereas the new ones have a 50°C jump between cones so that they will vary approximately 70°C. It really places the progressive manufacturer to a disadvantage.

A progressive man, you might say, having a product fusing at cone 32 can go out and say his product fuses around 3100°F, but the man using the old scale and having a brick fusing at cone 30 can go out and cite 3218°F, a difference there of 118°F. So we have tried to bring that point out and familiarize manufacturers with that discrepancy.

I believe in the application of the cone fusion test results. They go to their customer who has a report of 3218°F. (That is a familiar one.) He will immediately know that is cone 32 on the old scale and he can translate it in terms of the newer scale if he is using that. Another thing we have tried to bring out is the fact that the whole temperature scale at the time the older values were assigned was considerably higher than it is now. I believe that platinum was one of the standard points several years ago and it was considered as melting at 50° or 60°F, higher than it is considered at this time so that the whole upper range has been thrown off for that reason.

Coming back to the purely manufacturing standpoint I do not believe that there is anybody using pyrometers who does not check them or the cones with the pyrometers. It seems to me if a set of well standardized time-temperature curves were broadcasted to users of cones, it would at least show that the time was as great a factor almost as the temperature. By having a set of curves perhaps corresponding to the rate of heating up fire-clay brick which is fairly uniform and then going to fairly standardized period of oxidation which is not so great in this industry, that a man could find some curve there that would nearly hit his condition. If he insisted on knowing his kiln temperatures he could estimate it more reasonably than he can at the present time.

It seems as though rather than trying to get specific information along these lines that the educational work suggested by General Orton is a thing we ought to back up and as soon as possible for the benefit of the man who really wants to learn their advantage.

Chairman Harvey: I think Mr. Booze brought out the point from which the difficulty arises. If we only had one scale of temperature attached to cones, it would not make any difference what it was. We would speak the same language. Most of us appreciate the limitation and advantages of cones for measuring heat values and the trouble we are in is that one manufacturer and consumer specify a certain temperature which we have to translate into terms of cones and we do not know what scale they are working on. So if we can bring about a standardization which will be adopted by both the manufacturer and the industry as a whole, personally I do not think it makes any difference what it is—whether it is direct or indirect. So long as there is one of them, the cone number is as good as anything else.

DISCUSSION ON "IMMISCIBILITY IN HIGH SILICA MELTS"[1]

By J. W. Greig

Dr. Bowen: Hitherto the glass making oxides have for the most part been regarded as completely miscible. It is not so long ago that some glass makers thought that the lead-rich layers forming in the bottom of pots of flint glass were due to immiscibility but I do not think that anyone would urge that now. They are due to differential melting and settling of a heavy liquid not yet mixed but when it is mixed in any way it will remain mixed.

What I want to speak of now is a different matter—something that will not mix, just as oil and water will not mix. The story of this investigation goes back several years to a time when I myself was investigating the system, magnesia–silica. In that work it was found that in very siliceous melts the liquidus of cristobalite rose very steeply and suggested a very high melting point for cristobalite. Later Ferguson redetermined the melting point of cristobalite and found that, while it was considerably higher than had been supposed, it was not as high as the steep liquidus suggested.

On account of the temperature limitations of the platinum furnace the cristobalite liquidus had not been followed above 1650°C in any system. Several systems investigated showed the same very steep cristobalite liquidus, which fact, taken in conjunction with Ferguson's value for the melting-point of cristobalite (1710°) proved that the liquidus of cristobalite in all these cases must flatten in a very remarkable manner in compositions close to pure silica or that the liquidus is actually discontinuous as a result of the formation of two immiscible liquids. Having a platinum-rhodium resistance furnace at our disposal which would enable us to work at temperatures above those attained by the platinum furnace, it was decided to investigate the exact shape of the cristobalite liquidus at the higher temperatures where it had not hitherto been studied.

As a result of this work it was found that in some systems there is indeed a discontinuity in the cristobalite liquidus, due to the formation of two liquid layers. The systems in which the exact form of the cristobalite liquidus has been determined are the following: $CaO–SiO_2$, $MgO–SiO_2$, $SrO–SiO_2$, $BaO–SiO_2$. In each of these except the last it has been found that there is a high silica region in which two immiscible liquids are formed. With BaO there is a remarkable flattening of the liquidus but immiscibility is not shown.

A preliminary examination of the systems, $Na_2O–SiO_2$ and $K_2O–SiO_2$ has also been made and, while the full details of the shape of the liquidus

[1] Presented by N. L. Bowen at the Atlantic City Meeting, Feb., 1924 (Glass Division).

of cristobalite in these systems is not determined, enough has been done to show that there is no region of immiscibility.

Dr. Insley: Could you imagine such a case in which the silica liquid was the dispersed phase and the low silica was the dispersion medium?

Dr. Bowen: I can imagine such a case but we have never found it. Probably it has something to do with the surface tension phenomena. Even when we have a very large excess of the lime phase it occurs as globules, with thin films of the other phase.

DISCUSSION ON "THE SYSTEM Al_2O_3–SiO_2"[1]

A. A. Klein: I think this paper is an exceptionally fine contribution. The Norton Company have been doing quite a little work with alumina-silica fusions of the general composition of sillimanite. When working to the ratio $Al_2O_3.SiO_2$ with the purest raw materials we had, we invariably ran into crystalline material, supposedly sillimanite, containing 6 to 10% glass. This did not seem of particular significance because glass has been reported as a usual constituent of artificial sillimanite. However, within the past few months, we have been working with compositions on the high alumina side of the $Al_2O_3.SiO_2$ formula. For instance, a fusion with a composition of 75% Al_2O_3 and 25% silica should give on the basis of the $Al_2O_3.SiO_2$ formula an excess of corundum equal to 30%. As a matter of fact, we estimated not more than 2–3% of crystalline alumina present. We first thought that the analysis of the batch was wrong but in checking up the analysis it was found correct. We were, therefore, led to the assumption that there existed either a solid solution of alumina in sillimanite or else that artifical sillimanite was not $Al_2O_3.SiO_2$ at all but of a composition richer in alumina.

About that time Dr. Bowen presented a paper at the Geological Society which practically cleared up the whole situation, indicating the existence of $3Al_2O_3.2SiO_2$ and showing that so-called artificial sillimanite was of this composition rather than that of the natural mineral, *viz.*, $Al_2O_3.SiO_2$.

Prof. Wilson: As I brought out this morning in discussion of the paper on sillimanite, our work in melting batches of sillimanite in the electric furnace in 200 or 300 pound lots has checked up with Dr. Bowen's results very nicely. We have found, however, that the $3Al_2O_3.2SiO_2$ sustaining melting incongruity is hardly checked up by our results. We have produced a great many ingots of that composition and of higher Al_2O_3 and in no case have we found any corundum.

[1] See N. L. Bowen and J. W. Greig, *Jour. Amer. Ceram. Soc.*, **7** [4], 238(1924).

Dr. Bowen: It is all liquid, then cooled. Crystallization may not begin until you get down to $3Al_2O_3.SiO_2$, in which case you get corundum. You have to hold it for a considerable time to get the desired form. We always work in that way until we obtain the equilibrium.

Prof. Wilson: In making a big melt it cools comparatively rapidly. Would you expect us to get any corundum at all until the mixture is well above the $3Al_2O_3.SiO_2$ ratio of alumina?

If that sustains melted incongruity it would not act as a pure chemical substance and melt down from the sides but it would tend to slump more or less. In our tests we have always found that $3Al_2O_3.2SiO_2$ would also melt down as a cake of ice—melt down from the sides. The cone would actually melt away at the melting temperature, whereas if the material melted along that cooling curve you would get a series of liquids supporting solids and it would be a case of slumping rather than actual melting. In that respect only do our results not bear out your large scale experiments.

Dr. Bowen: When you heat or cool a thing very rapidly you need not get the equilibrium conditions. Very much more melting will go on than does go on at a given temperature.

Prof. Wilson: As I understand it, your 3 alumina 2 silica combination is not a chemical compound.

Dr. Bowen: There are many other types of compounds that have this incongruity. Not only do you get alumina in that 3 to 2 combination —you get it in the one to one. You get natural sillimanite.

Prof. Wilson: Starting lower than one to one, and bringing the alumina up and above three to two, we do not get any corundum, but when we have gone above the two to three ratio, the corundum appears.

Dr. Navias: Has the viscosity of the SiO_2 and Al_2O_3 mixtures been determined? Of course the viscosity will greatly influence the time element sufficient for the formation of crystals.

Dr. Bowen: We have tried to make glasses of these mixtures for the purpose of determining their viscosity partly to know what they are and partly to determine the composition of their liquid phase, sometimes a very useful thing. We find it impossible to cool the glass rapidly enough to prepare a glass beyond the one to one proportion. We have prepared glasses of silica and on over in the neighborhood of one to one composition making a very minute amount and letting it fall under the furnace. Beyond the one to one ratio you cannot cool rapidly enough even to get it to glaze. The viscosity affects the crystallization very materially and the rate of crystallization indicates the viscosity increases regularly from the point one to one and presumably over to an alumina. It may not be a linear change but certainly there is a general increase in the viscosity going toward silica, a decrease in going over to alumina.

MISBRANDING RAW MATERIALS AND CERAMIC CHEMICALS FOR GLASS MANUFACTURE[1]

Dr. Silverman: My attention was first called to misbranding during the war, although it had undoubtedly existed for many years. I happened to be at a glass factory at a time when a beautiful specimen marked "Nitre Cake" was brought in and placed on the president's desk and he decided at once that he was going to order some since the dirty looking South American nitre was very scarce and costly and he could get this for two cents a pound. I told him if he would send empty freight cars to some of the nitric or hydrochloric acid plants that he could get all he wanted by paying the freight; that it was not nitre, that it was a by-product of the nitric acid industry, and that if he ever introduced it into a pot of lead glass he would regret the day he began the experiment. I have been on the watch for such cases ever since, and in the course of my work during the last five years have run into a number of materials which were misbranded.

One of the worst acts in the whole lot is the selling of an article which is called synthetic "cryolite," which, according to analysis contains fluorspar, sodium silicofluoride, feldspar and quartz or sand. It sells at about six and one-half cents a pound and there are a lot of gullible manufacturers buying it. One of the members of the Glass Section of the Society said that it serves the manufacturer right if he pays the price for this material instead of having a chemist in control of the work in his plant.

In a single instance, where we made the anlaysis and substituted the materials themselves instead of buying synthetic "cryolite," so-called, the cost per pound was reduced from six cents to two cents, and the saving in a single glass, of which only three or four pots were made per day, was over $5000 per annum. You can get a pretty good chemist for that sum and the glass manufacturer ought to realize what the purchase of such material means.

There is another preparation which is sold together with formulas for the making of the glass, which contains plaster of Paris, sodium silicofluoride and feldspar. It also sells at six and one-half cents to seven cents a pound. There was also an earlier mixture, known as Opaline, which brought a good price.

I do not know that we can object to the sale of a material or a mixture of materials under a trade name because that is business for the fellow who is clever enough to put it over, but we certainly can object to the misbranding of an article put on the market as cryolite that contains no cryolite. I believe that the American Ceramic Society ought to go on

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Glass Division).

record asking for the enactment of a law governing commercial chemicals, in much the same way as food products are governed by the Food and Drug Law.

Dr. Shively: This suggestion of Dr. Silverman is really a fine one. I have visited glass plants and have had occasion to get in their mixing rooms and find out what they have. You would be surprised to know the number of them that have fallen for these so-called preparations, that as has been explained are being exploited. You would be surprised to know how many people have bought them and have never tried them out. They buy them, influenced by the salesmanship of the man selling them, and after they get them, they put them aside to be used some time later.

Dr. Shively, Dr. Silverman and Mr. Blau were appointed to write out the resolutions and reported as follows:

Resolved: That the Glass Division of the American Ceramic Society urge the United States Government to enact a law similar to the Food and Drugs Act, controlling interstate shipments of ceramic chemicals for the purpose of preventing misbranding and adulteration of said chemicals and raw materials. Further, that other Divisions of the American Ceramic Society be asked to take similar action leading if possible to a resolution to be presented by the National Society.

Mr. Modes: What does that cover?

Chairman: Ceramic chemicals.

Mr. Modes: What compounds do you expect to control?

Dr. Shively: That controls, as I understand, all raw materials and chemicals that enter into the manufacture of ceramic products. I might say that since this resolution was drawn I found out through a representative of one of the large houses here that there is already a law which controls misbranded interstate shipments, providing anybody wishes to push it.

Mr. Modes: It is not expected to cover a man who makes a compound or a preparation?

Dr. Shively: No.

Mr. Modes: If he ships feldspar and it is sold as that and not under some mysterious name?

Dr. Silverman: If a man wants to sell something under a trade name and the glass manufacturer wants to buy something under a trade name, that is not covered by our Resolution, but he cannot sell a mixture of substances which do not contain cryolite as synthetic cryolite. Synthetic cryolite has a definite composition and it is supposed, according to the specifications of Grünwald and others, to contain a certain percentage of cryolite. If he wants to sell something under a trade name, for instance, Opaline, that is his business. He is selling a mixture for coloring some ceramic product but he cannot call it cryolite if it is not cryolite.

If an act already exists which covers this, our resolutions should be changed urging the enforcement of that act rather than the creation of a new one.

The resolution was amended as follows:

RESOLVED: That the Glass Division of the AMERICAN CERAMIC SOCIETY urge the United States Government to enact a law, or enforce one if already existent, similar to the Food and Drugs Act controlling interstate shipments of ceramic chemicals and raw materials for the purpose of preventing misbranding and adulteration of said chemicals and raw materials. Further, that other Divisions of the AMERICAN CERAMIC SOCIETY be asked to take similar action leading if possible to a resolution to be presented by the National Society.

Resolution carried.

DISCUSSION ON "CONDUCTIVITY OF SODIUM CHLORIDE IN SODA LIME GLASS"[1]

MR. GREENE: May I ask if the glasses melted showed any signs of opalescence?

DR. SILVERMAN: The glass was not an opal glass at all. It was a crystal glass.

MR. GREENE: The chloride had no effect in producing opalescence?

DR. SILVERMAN: No, there was no opalescence except in a few instances where there was a small amount of devitrification around the electrodes. We attributed that to unusual conditions and in those cases the determinations were discarded. In the majority of instances we had a clear melt and there was no devitrification. We found when we got beyond 1.41% sodium chloride content that the salt would form a separate liquid layer and then the results had to be discarded because we were getting the conductivity of the fused salt as well as that of the solution in glass.

DR. SHIVELY: I come in contact with a number of opal manufacturers who use calcium sulphate. They claim that it has some effect in increasing their opalescence. In this work of yours did you find that the presence of electrolysis had any influence on that?

DR. SILVERMAN: I have found in research on opal and alabaster glasses that the moment you introduce chloride or a sulphate there is that effect. There is a tendency to precipitate a certain amount of material and increase the density of the glass. Of course, there are various theories that have been advanced. One is what we were trying to prove here, that salts in solution in the glass ionize and precipitate the colloid. The other is that it is entirely an oxidation phenomenon and the latter has some support. For example in an investigation that was conducted a few years

[1] See Willard J. Sutton and Alexander Silverman, *Jour. Amer. Ceram. Soc.*, **7** [2], 86(1924). Discussion presented at Atlantic City Meeting, Feb., 1924 (Glass Division.)

ago an alabaster glass that was left in the pot long enough to become crystal lost color entirely. At the suggestion of a workman in the plant we played a stream of air on the surface of that glass because we were told that the air would cool that glass down and that when it was melted again it would be alabaster. It seemed incredible that a thing like that should happen as it did. I looked over all of my batches on opal and alabaster glasses to see whether oxidation played a part. There was not one batch in which we did not employ an oxidizing agent. If we used sulphates at high temperatures as oxidizing agents when the chlorides were used alone we got no opalescence, and no alabaster effect unless nitre was introduced or some other oxidizing agent. Even with a chloride and an oxidizing agent there is the possibility that the increased opalescence is the result of oxidation and not the effect of electrolytes in solution.

MR. PAYNE: I was trying to find a substitute and an improvement over arsenic as a clarifier. We tried potassium chlorate in small quantities and substituted in a small experimental tank a bleaching powder, calcium oxychloride. We put in all of the CaO which ran to about 8% of the total in the form of oxychloride with no sign of opalescence resulting.

DR. SHIVELY: A number of manufacturers in making flint glass use as high as 25 pounds of sodium chloride to a thousand pounds of sand. They claim it prevents the formation of scum. I know of one place where every manufacturer in that immediate district used sodium chloride. There is a lot of sodium sulphate being used to prevent scum but in one particular location a number of them used sodium chloride.

DR. SILVERMAN: Is the temperature high enough to drive off the salt?

DR. SHIVELY: 2700°F.

DR. SILVERMAN: I should think they would find it difficult to drive off salt; it would create a high tank corrosion.

DR. SHIVELY: They are doing it right along. They are using it regularly in one locality. It seems that some man tried it out and found that it gave him good clear glass and free from scum. He notified the other people in that immediate vicinity about it and they are all using it now.

DR. SILVERMAN: Of course, you have an advantage in the use of floats in a tank. Any chloride layer on top stays out of the working end of the tank, but you can hardly get over $1^1/_2$% sodium chloride into solution and the surplus is going to form a liquid on top like oil on water.

DR. SHIVELY: Twenty-five pounds of chloride would not be a great amount to 1000 pounds of sand.

DR. SILVERMAN: You are beyond the sodium chloride solubility limit, you will find.

A MEMBER: You speak of the solubility limit on sodium chloride in such glasses. That varies with the temperature. You speak of 1.41. Can you give us any idea at what temperature that holds?

Dr. Silverman: The curves show the conditions under which the experiments were run. The maximum temperature in this particular series was 1100° to 1150°.

A Member: And then that figure holds at the maximum temperature?

Dr. Silverman: Yes, it holds at that temperature. We actually found a salt layer on the surface of the glass when we got beyond 1.41%.

A Member: Does the solubility decrease with temperature?

Dr. Silverman: It becomes slightly less, but this was the greatest amount we could introduce at any temperature within the limits of our investigation.

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?
2. What difference is there between the properties of a soft mud machine-made and a hand-made brick?
3. Can an iron-free clay brick be made for blast furnace service?
4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?
5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?
6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand-made fire brick?
7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?
8. What is the reason for the more rapid failure at a lower temperature of fire brick subjected to reducing atmosphere than will obtain with the same brick under oxidizing conditions?
9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?
10. At what temperature does fire clay break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_32SiO_2$?
11. What properties should a clay brick possess to give good service in rotary cement kilns?
12. What properties should a clay brick possess to give good service in vertical shaft lime kilns?
13. How can the water content for wet pan charges be gaged?
14. What simple laboratory tests can be used to keep the quality of refractories up to standard?

Question

At what temperature does fire-clay brick break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_32SiO_2$ which has been called mullite?

Discussion

"In general number 1 fire clays dissociate into aluminum silicate and glass. The probable composition is $3Al_2O_32SiO_2$. The temperature at which crystals of the latter appear distinctly enough so that they can be distinguished optically, ranges from somewhat under 1300°C to above 1350°C.

"Concerning the composition of aluminum silicate, our experience with fusions of the products running high in so-called sillimanite compositions verify the work of Bowen and Greig.[1] We assume that their findings hold true in porcelains and in fire-clay refractories.

"Our experience has been that the formation of this crystalline constituent progresses during the service of the brick under high temperature conditions. In no case, however, unless there be the fluxing action materials introduced extraneously, do the crystals of aluminum silicate grow to a large size and to perfect development."—A. A. KLEIN, Norton Company. From joint notes of Herbert Insley and A. A. Klein.

Hewitt Wilson states that Bowen and Greig have answered the question regarding the composition of the aluminum silicate formed in fire clays under high temperatures. His letter proceeds as follows: "We have no data on the development of mullite in fire-clay brick for we have been working with purer materials carried to melting temperatures in the electric furnace. We did get the mullite-corundum crushed fragments to re-crystallize as low as cone 20 in an oil-fired furnace.

"We do not believe that the development of mullite in the ordinary fire-clay brick has much effect on the internal structure of the brick because the quantity of crystalline material is too small to produce strength by an interlocking of crystals when compared to the amount of amorphous material plus fused glass.

"Mullite crystals will form in high temperature silicate fluids, such as the Orton cones, or at low temperatures in such liquids as melted PbO, provided the alumina-silica ratio is high enough. Crystalline glazes can be produced by making a super-saturated solution of mullite in PbO glass."—HEWITT WILSON, Univ. of Washington.

Question

What is the relation of this formation of $3Al_2O_32SiO_2$ and silica glass mentioned by Bowen and Greig to the condition seen in fire brick after long service in high temperature

[1] N. L. Bowen and J. W. Greig, "The System Al_2O_3–SiO_2," *Jour. Amer. Ceram. Soc.*, **7** [4], 238; **7** [5], 410(1924).

brick kilns and flues, when the greater portion of the brick appears to be black glass with occasional white flint clay grains or quartz particles?

Discussion

"The black glass found in fire brick after long service at high temperatures often contains mullite crystals but unless the latter form a thick coating on the surface to retard slag attack, they cannot be of much importance. In our tests with purer materials, even small amounts of glass produced 'internal lubrication' of the crystalline structure and we believe that this accounts for the ear slumping of the first artificial 'sillimanite' refractories."—HEWITT WILSON, Univ. of Washington.

"The condition where the brick appears to be a black glass with occasional white flint clay grains or quartz particles seems to us, without having examined the product, to be a case of fluxing, probably as a result of reaction with constituents of the combustible. We have had occasion to examine the back of a fire-clay piece in contact with an oil flame for a long period of time. This was coated with a milky white vitrified substance which was found to consist of a clear glass containing well-developed sillimanite needles. In this particular case the flux was soda, which was found in very small amounts in the oil."—A. A. KLEIN, Norton Company. Further discussion of these questions has been solicited but is not now ready for publication. Those readers interested are requested to contribute to the discussion for an early number of the Question Box.—Ed.

Question

Will results in service justify the use of super-refractory brick, and the added expense necessary in the proper fabrication of such a refractory?

Discussion

The following extract from private correspondence with a furnace engineer and designer gives some figures and reasons why a super-brick is desirable in certain cases.

"There are a number of water-cooled ports used in open hearth furnaces in this country and none at all in Europe. The ports are extremely expensive and require considerable attention. They wear out rather frequently. The only reason they are used is because when ordinary fire brick of the best grade are used it does not permit the forcing of the furnace which is so much desired in this country. For example, if an O. H. furnace costing, with all the equipment that goes with it, about $1,000,000 can be forced so as to yield 25% more steel per year, the investment of $1,000,000 will yield a gross income 25% greater but a net income of probably 50% greater. The cost therefore of a high grade fire brick is not an important consideration in comparison to its value if it will do the work.

"In certain other types of furnaces we would arrange the ports and the combustion chamber in a more efficient manner if we could get refractory materials that would stand the service. We are continually modifying our designs so as to meet the limitations of the fire brick we have to use. Then again in certain types of furnaces where the heat is extremely high, in fact in almost all types of furnaces where the temperature is over 2700°F we are obliged to use a crown that is but nine inches thick. We do this so that a large portion of the heat will be wasted by radiation and leakage through the roof and thus prevent the hot side of the roof from becoming over-heated. If we could get a brick that would stand 3000° continually we would build the roof with an extra rowlock of brick over it to hold the heat in. Our furnaces would then be more efficient. In many cases it would save at least 10% of the fuel. This of course would amply justify the use of an expensive fire brick."

Question

What properties should a clay brick possess to give good service in lime kilns?

Discussion

"To cover the matter of lime kiln linings a discussion of several pages in length would be required. Briefly, there is to the writer's knowledge no one type of refractory which is best suited for all types of lime kilns. This is represented in a great variety of service conditions such as, method of firing, kind of fuel, kiln output, temperatures obtained, analysis of stone, kiln design, etc. For instance, for a shaft kiln, we are apt to find different refractory service requirements for the fire box and the burning zone, which is a variable in the kiln itself, and again refractory requirements may vary from kiln to kiln, depending upon whether the furnace is hand fired or gas fired.

"There are also types of vertical lime kilns in which the kiln is fired not by having fire boxes at the base, but by mixing coke with the charge and the combustion takes place in the main chamber proper. Briefly the matter of refractories for vertical is covered as follows: The chief requirement of the lining for the upper zone is that it resist abrasion or wearing action of the stone and that it be only moderately refractory. For the portion of the kiln extending from eight to fifteen feet above the fire box, the brick must necessarily be of high refractoriness, at the same time showing good mechanical strength and resistance to abrasion, and also have a moderate resistance to spalling action.

"Under certain conditions, where either the stone is somewhat impure or where very high temperatures are obtained, it is often economical to use a high alumina type of liner, which is more inert to the chemical action of the charge.

"With respect to the rotary type of lime kiln, the lining for both firing and cold zone must resist abrasion or wearing action and the lining in the firing zone is, perhaps, on the whole, subjected to higher temperatures and to more severe chemical action than is true in the case of the vertical kiln. This fact has led to the extended use of the super-refractory of high alumina type of rotary hot zone liner in the lime industry.

"The whole problem, therefore, of refractories for lime kilns dissolves itself into the matter of analyzing each service condition."—L. C. HEWITT, Laclede-Christy Clay Products Co.

Question

What is the cause of the swelling of fire brick in the hearth of a lead blast furnace after the furnace has been blown out and is allowed to stand idle?

Will a high alumina brick resist metal absorption in a lead furnace? If so, what is the minimum alumina content required in such a brick?

What is the best type of refractory brick for lead blast furnace work?

Discussion

The following data is submitted to give the preceding question on lead furnace refractories a background and does not attempt to answer or discuss them. The information was secured from an operator of a battery of lead blast furnaces. The furnace construction includes the customary fire-brick hearth, water cooled jackets at and above the tuyères, and a fire-brick stack of rectangular cross-section.

Some years ago considerable experimental work was done in re-lining the furnaces to find a refractory which if possible would cut down the metal absorption. It was felt that if some such brick could be found it would pay to use it even though the first cost of the brick were high. The highest absorption occurs in the lead crucible and is apparently unavoidable on account of the great weight of metal contained. In addition to the mechanical difficulties introduced by the expanding brickwork, the re-smelting cost and the interest charges on precious metals tied up in the lining is quite an item. There is more or less slag absorption above the metal line and in the slag pocket.

In the search for a non-absorbent refractory many brands of first grade brick from all sections of the country were secured and installed in the most painstaking manner. Accurate records of the weights of all brick used were made, both before installation and on tearing out. No apparent difference in lead absorption was noted in any of the brick per unit of weight.

After trying several brands of first quality and a few brands of intermediate duty brick, one product was selected as giving promise if it were ground finer and fired harder. Accordingly brick were secured which were made by three different processes (dry press, stiff mud, hand made repress), the

ingredients being finely ground and the brick fired very hard. These three types of brick were installed in the same lead crucible together with hard fired, coarse grind, grogged brick regularly furnished by this manufacturer, a quarter of the lining being made up of each kind of brick. At the end of the run a few whole brick of each kind were removed. There was no apparent difference in the amount of lead absorbed by any of the brick.

Brick tested in the first general investigation included some from the Missouri, Kentucky and Pennsylvania fields and were nearly all made from normal fire clays. No alumina content higher than 35% was noted. Some intermediate duty or low duty brick with silica content ranging from 60 to 72% were also used. The cheapest and most accessible brick is now in satisfactory use and there appears to be no reason for making a change unless further test of the recently developed high alumina brick should show an advantage over the cheap brick in service. The following analysis is typical: SiO_2 69.6–, Al_2O_3 24.6–, Fe_2O_3 1.3–, CaO 1.9–, MgO 1.6–, loss 1.0–, fusion cone 29–30.

Fire brick swell considerably as they absorb metallic lead making necessary a more or less flexible expansion joint between the water cooling jackets and the stack. This consists of two courses of reversed wedges of magnesite brick which permits adjustment. The stack must be self-supporting. As soon as the expansion joint is closed entirely the hearth must be rebuilt and the smelting zone relined.

When the brick have become completely impregnated with lead there appears to be no tendency for the metal to go through to the wall or jacket as in the case of copper penetration, but the brick continues to swell and absorb more lead.

If a furnace is operated for several months until the brickwork is filled with lead, then blown out and allowed to stand idle for a time, the hearth and lining will continue to swell and puff up. If allowed to stand long enough the expansion joints would gradually close up tight and require a rebuilding of the furnace. The brick do not go to pieces, probably on account of the complete impregnation with lead which being ductile allows the further expansion without rupture, and the furnace may be blown in again if required provided the expansion joint is wide enough to warrant it.

Metallurgical coke is used for fuel, which is mixed with the charge of roasted ore. About 30% of scrap iron is added to the charge to facilitate the melting.

Discussion of the questions listed above is solicited.—Ed.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

An American Ceramic Institute

Since last May, when the idea of the Ceramic Institute was first presented on this page, much advancement has been made. However, the Ceramic Institute as it stands today is still only an idea, an idea entirely different from what it was a month ago, and quite different from what it was several months ago. Very probably it will be very different from what it is now, after we discuss the matter at the Columbus meeting next February. Any detailed propositions which have been made have been given so that we can discuss the matter. The Ceramic Institute idea is to find some method of organization so that a real research program can be financed and carried out without duplication.

Every function of this Society of ours revolves around one fundamental purpose: to bring into one organization all the men who are striving to improve the products of the silicate industries, and to provide for them the advantage of benefiting by the experiences of their fellow workers through personal discussion at our meetings, and through the formal papers given in our publication. At first a very simple organization was satisfactory. At the Section Q meetings, practically the whole membership could sit at one table, but as the scope of our activities expanded, division into groups was necessary, and we have today the advantage of seven technical societies represented by our Divisions, held together in one well-knit organization, with the committees so interwoven that there is no duplication of activities. Our organization is successful, for we have, at a very small general expense, so guided our activities that the results are astounding.

No country in the world can boast of accomplishments such as ours in the ceramic field, and, without doubt, it is due to our organization in this Society. We are at the point now, though, where it is very necessary that some arrangement be made whereby research in our industries can be initiated according to a definite program. Up to this time, the research which has been done has been initiated by our individual members, and for the most part, has been merely reported at our meetings and in our publications. The American Ceramic Society is the organization which can most quickly bring into being a Ceramic Institute today to do this very thing.

Although the interests of all the silicate industries are very closely allied, and a great deal of the research which should be done is fundamental to each and every one of the industries represented, still a large portion of the problems fall very naturally into groups which are represented by our different Divisions. Therefore, I feel that the Ceramic Institute should be a federation of several specific Institutes.

The Clay Products Institute is already being organized, and care should be taken that this does not become so complex that individual initiative is hampered. There should also be formed a Glass Institute, a Terra Cotta Institute, a White Wares Institute, and an Enamel Institute, each of these centralized in the Ceramic Institute. The organization of these specific divisions can be initiated by the trade associations of the industries represented, or by the Divisions of our own SOCIETY in collaboration with these trade associations.

In any plan that can be evolved, there must be a research head, a salaried man to coördinate all of this work and to see that the fundamental work which is useful to each and every separate Institute is done and not duplicated. This man should be definitely connected with our SOCIETY. Such a man would be in the position to determine just what part of the work could be done in the individual plants interested. He would determine what work could be done in laboratories such as can be found in the various schools. This would mean the establishing of more Fellowships. He would know the facilities of the various Government laboratories, and determine what part of the work could be done in these. He would lead in the formulation of a research program and see that this was carried out. He would be the research director of each of the separate Institutes, and head the committee on research in our SOCIETY.

The AMERICAN CERAMIC SOCIETY has a big job ahead of it in guiding this tremendous idea. Research as we know, does cost money, but we know, too, that research properly guided probably yields the largest returns that can be obtained from money invested in any way. Real research is expensive. Care must be taken that there is no duplication.

In any event, the most economical plan will be for the AMERICAN CERAMIC SOCIETY's general offices to take care of all of the organization work. The general meetings would be one and the same. The Ceramic Institute itself should be very closely connected with our SOCIETY, but each of the component Institutes should be separate from the SOCIETY and self-determining.

Each of us, and especially those in charge of the divisional work, should give this matter their most careful thought, and at the Columbus meeting, definite plans should be made to initiate the organization of each of the separate Institutes. We have the opportunity here to initiate a coöperative plan such as has never been dreamed of in any field, and one which will bring actual results to the silicate industry. I hope that each one who reads this and is interested, will give this matter immediate and careful consideration and try to formulate some definite plan, so that when we get together in Columbus, we can make a real start. This plan must be built on a secure foundation, and we need the best from every worker in our SOCIETY.

NEW MEMBERS RECEIVED AUGUST 15 TO SEPTEMBER 15

PERSONAL

Butler, E. L., 111 W. Washington St., Chicago, Ill., Owner and Manager, E. L. Butler Clay Co.

Farr, Harry V., 2 Miller Place, Ferguson, Mo., Consulting Engineer, Maphite Company of America.

Gasteiger, W. H., Braemar, Carter Co., Tenn., Engineer, Rex Company.

Innes, David H., 905 S. Wright St., Champaign, Ill. Student.

Kriege, Herbert F., 1354 Forsythe Ave., Columbus, Ohio. National Agstone Fellow, Soils Dept., O. S. U.

von **Krogh, Johan C. W.,** Geologisk Museum, Kristiania, Norway. Engineer, Norwegian Government.

Purky, Jos. F., Paducah, Ky., Manager, The Paducah Clay Co.

Sargent, Malcolm C., 163 Norfolk St., Wollaston, Mass. New England Sales Manager, General Refractories Co.

Vane, Bernard, Supt., Hopewell China Corp., Hopewell, Va.

Membership Workers' Record

	Personal
R. F. Geller	1
Joseph A. Martz	1
Cullen W. Parmelee	1
C. A. Underwood	1
H. E. Weightman	1
W. W. Wilkins	1
Office	3
Total	9

PROGRAM FOR SOCIETY SUMMER MEETING, LOS ANGELES, CALIFORNIA, OCTOBER 6 and 7, 1924

Morning Session

Opening Address.............................Ross C. Purdy
Tableware on the Pacific Coast.................W. G. Jackson
Artificial Sillimanite as a Refractory.............Hewitt Wilson
Synthetic Sillimanite in Ceramic Bodies..........T. S. Curtis
Overhead Transportation in a Clay Plant by Engineering Department of the Los Angeles Pressed Brick Company........Ross D. Plank

Afternoon Session

Cast Iron Enamels (with microphotographs)......A. Malinovsky
Sagger Rules for Control of Glazes...............Ross C. Purdy
Notes on Terra Cotta Body Shrinkage...........P. G. Larkin and E. R. Curry
Notes on Development of Vitreous Slips for Terra Cotta...................................H. E. Davis and J. S. Lathrop
Tunnel Kilns....................................E. W. Ekstrand
Construction of Kiln Crowns..................John Sawyer

THE PITTSBURGH SECTION HONORS ENGLISH GUESTS

Dr. J. W. Mellor and Dr. and Mrs. W. E. S. Turner were honored with a dinner at the University Club, Pittsburgh, Pa., given by the Pittsburgh Section, American Ceramic Society on Thursday evening, Sept. 4, 1924. Eighty-eight members and guests were present.

J. W. Cruikshank, of the Cruikshank Engineering Company and Chairman of the Section, proposed the drinking of toasts, first to the King of England, complimentary to the distinguished English scientists and next to the President of the United States. Mr. Cruikshank expressed the appreciation of the members of the Pittsburgh Section in having the honored guests with them. He also recalled his acquaintance with Dr. Turner in 1918 at which time he was in England, and visited Dr. Turner at the University of Sheffield.

The toastmaster for the evening was Dr. Alexander Silverman, head of the Chemistry department of the University of Pittsburgh. Dr. Silverman emphasized the importance of the glass industry to humanity; what it means to have windows, both plain and stained to keep out undesirable elements and yet admit light and warmth; the value of glass as an artistic decoration for our homes and finally the vital importance of binoculars for our mariners; telescope lenses, etc.

Dr. W. E. S. Turner of the University of Sheffield and past president of the Society of Glass Technology of England expressed his appreciation for the hospitality that had been extended to him on the present visit to this country and also on two previous trips. On behalf of the British Society he extended a cordial invitation to the members of the American Ceramic Society to visit England in the near future. Remarks were also made pertinent to the comparison of the two countries, England and America. England, he stated, has not recovered from the depression of 1920 to the same extent as America. Dr. Turner referred to the wonderful achievements that are the direct outcome of research and urged upon the Society the importance of this country to establish a center for the advancement of glass technology.

He discussed the results of his experiments with wet and dry glass batches on which eight tests were made on the same materials. The molten metal was worked by the same man who knew nothing of that particular batch with results showing that while the ingredients of the batches were the same, the glassware made from the wet batch was entirely different from that produced from the dry materials.

Dean Manning of the University of Pittsburgh discussed our recent national conventions of the Republican and Democratic parties.

Chancellor Bowman, also of the University of Pittsburgh, questioned the efforts of the scientists of this country to relieve the restlessness existing among laborers in industry. He emphasized the fact that one hundred

years ago the population of this country was occupied chiefly with securing household comforts and necessities and stated that present-day problems should be subjected to scientific study as much as chemical problems. He mentioned the services which have been rendered to various industries by the Mellon Institute, and noted the excellent facilities afforded by Pittsburgh to train efficient workers and for straight thinking.

Dr. J. W. Mellor, eminent chemist and ceramist of Stoke-on-Trent, also gave an entertaining address. Dr. Mellor has been attending the recent convention of the British Association for the Advancement of Science in Toronto. He has made highly valuable contributions to the ceramic field and has written many books on chemical subjects. He is also an authority on higher mathematics.

Ross C. Purdy, Secretary of the AMERICAN CERAMIC SOCIETY, was introduced and made a brief talk.

Those in attendance at the meeting were:

E. W. Tillotson
Mrs. Tillotson
A. V. Bleininger
Chancellor Bowman, U. of Pgh.
W. E. S. Turner
Mrs. Turner
J. W. Cruikshank
Dean Manley
J. W. Mellor
H. L. Dixon
Mrs. Dixon
Louis Reizenstein
Ross Purdy
Alexander Silverman
Cyrus G. Dunkle
John F. Byrne
Sandford S. Cole
Mrs. Cole
R. F. Ferguson
R. A. Robinson
J. E. Hansen
B. M. Larsen
Chas. R. Fettke
Chas. Watkins
C. E. Greider
Chas. L. Jones
Gordon R. Pole
G. E. Meiter
L. O. Peterson
H. J. White
Mrs. White
C. R. McCann
Mrs. McCann

Donald W. Ross
G. W. Cooper
John M. Hammer
George S. Cooper
F. C. Flint
A. H. Wright
Horace Foster, Jr.
Miss McKillop
M. G. Babcock
A. W. Kimes
Mrs. Kimes
R. E. Kimball
Mrs. Kimball
Wm. J. Miller
V. G. Greene
F. A. Rotandaro
Joseph Heidenkamp
Miss Heidenkamp
Joseph Heidenkamp, Jr.
Mrs. Heidenkamp, Jr.
W. A. Turner
Thos. MacConnell, Jr.
J. O. Handy
Harry S. Hower
Mrs. Hower
H. H. Blau
C. A. Stimpson
W. E. Daugherty
H. R. Urbach
W. F. Wenning
H. V. Huber
J. B. Luckie
Glenn D. Williams

Fig. 1.—Pittsburgh Section, American Ceramic Society, Sept. 4, 1924.

Harry Willetts	C. H. Walker
Mrs. Willetts	R. J. Weithorn
D. W. Loomis	H. S. Robertson
F. M. Ritchie	E. P. Arthur
Mrs. Ritchie	Mr. Stewart
T. F. Harnock	J. M. Manor
Mrs. Harnock	T. A. Shegog
H. G. Dixon	H. A. Thrum
Mrs. Dixon	C. L. Shegog

PITTSBURGH SECTION HEARS BRITISH CHEMIST

The Pittsburgh Section of the AMERICAN CERAMIC SOCIETY met with the Pittsburgh Section of the American Chemical Society on Friday, September 19 at the Pittsburgh Experiment Station, Bureau of Mines, where they heard an address by Sir Robert Robertson, Chemist to the British Government. Sir Robert, who is an authority on the chemistry and technology of explosives talked on "Ammonium Nitrate and Some of Its Properties and Applications."

L. E. BARRINGER AT CENTENNIAL CELEBRATION

President Landrum has appointed L. E. Barringer of the General Electric Company, Schenectady, N. Y., to act as representative for the SOCIETY at the Celebration of the 100th Anniversary of the Founding of Rensselaer Polytechnic Institute to be held at Troy, N. Y., October 3 and 4.

DR. LANGENBECK REPRESENTATIVE AT MEETING

Karl Langenbeck, U. S. Tariff Commission, Washington, D. C., was appointed representative of the AMERICAN CERAMIC SOCIETY by President R. D. Landrum to attend the Centenary Celebration of the Founding of the Franklin Institute and the Inauguration Exercises of the Bartol Research Foundation. This meeting was held in Philadelphia, September 17, 18 and 19, 1924.

G. A. BOLE ADDRESSES NORTHWEST STATION

G. A. Bole, superintendent of the Ceramic Experiment Station, U. S. Bureau of Mines, Columbus, Ohio, has returned from an extended trip to the Pacific Coast where he made a survey of clay plants and visited the Bureau Stations at Seattle, Wash., and Berkeley, Calif. While in Seattle Mr. Bole was guest at a luncheon given by the members of the Pacific-Northwest Section. The work of the U. S. Bureau of Mines was presented by Mr. Bole in an interesting address at this meeting.

He also visited the Station located at Rollo, Mo., where research work in zinc refractories is being conducted.

FELDSPAR INVESTIGATION[1]

On page 357, *Bulletin* Section, September number of the *Journal*, a typographical oversight made the entire note read as though it were by Dr. Burgess, director of the Bureau of Standards. The first four paragraphs of that note were not a part of Dr. Burgess' communication.

NOTES AND NEWS

THE EDWARD HART CELEBRATION

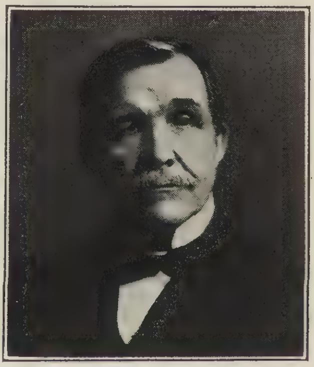
The American Ceramic Society joins with Dr. Hart's many other friends in real appreciation of the friendly man, the interesting writer, the practical scientist and the business man and associate, Edward Hart.

Dr. Hart has been an active member of this Society for several years. When possible he attended our meetings and participated in the discussions. He undertook on his own responsibility the printing for the Society the "Collected Writings of Herman Seger." Dr. Hart has made substantial contributions to ceramic technology, the benefits of which will be shared by ceramists in future generations.

To Eugene C. Bingham we are indebted for the following notes:

In 1874 there came to Lafayette College as professor of analytical chemistry, Thomas M. Drown, later president of Lehigh University. With him there came as his assistant a young Quaker from Doylestown, Pa., by the name of Edward Hart.

Not satisfied with his knowledge of organic chemistry, in 1876 he applied for a fellowship at the newly started Johns Hopkins University. Dr. Remsen must have scanned young Hart more carefully than he did his college diploma, for the latter was nonexistent. Edward Hart was given the fellowship and he kept it for two years and received his doctorate into the bargain.



Dr. Edward Hart

Dr. Drown resigned in 1881 and Dr. Hart was then made assistant professor in charge of the department.

Dr. Hart had already started a series of business enterprises. In 1881, with John T. Baker, a Lafayette graduate of 1878, he began to make refined chemicals. They were without experience and with only \$500 capital, but they possessed plenty of courage. Renting land at \$10 per year, they put up rough buildings, erected furnaces, and started in to manufacture pure hydrochloric acid, nitric acid, sulfuric acid, and ammonium hydroxide. After two years their capital proved too small and they took in George P. Adamson, of the class of 1884, and moved the plant to a five-acre plot near the railroad. The use of crude nitric acid in considerable quantities suggested the manufacture of the acid directly from sodium nitrate, and this led to the invention of the Hart boiler and condenser, which are still widely used. Thus, with Dr. Hart as silent partner, the firm of Baker & Adamson was started, which was later merged into the General Chemical Company, and which in turn has merged into the Allied Chemical & Dye Corporation.

[1] Correction.

When he began to edit the *Journal of Analytical and Applied Chemistry* he found trouble in getting the *Journal* out on time, so he audaciously decided to be his own printer and in 1887 he engaged a student as the foreman of the proposed company. In 1893 Harvey W. Wiley, who had recently become president of the American Chemical Society, requested Dr. Hart to become the editor of the *Journal.* There thus started an intimate friendship which has increased with the passing years. Taking up the editorship, Dr. Hart found but two articles ahead while there were six numbers in arrears. He unselfishly gave up his *Journal of Analytical and Applied Chemistry* and merged it with the Society's *Journal.* Dr. Wiley busied himself in getting papers, while Dr. Hart edited and printed them. In 1894 he published the first volume of Dr. Wiley's "Principles and Practice of Agricultural Analysis," and a year later Dr. Remsen asked him to print the *American Chemical Journal.*

The growth of the chemistry department of the college under Dr. Hart was continuous. In 1918 friends of Dr. Hart raised $10,000 to endow the Edward Hart Research Fellowship, as a tribute to his great service in building up chemistry in America. Although Dr. Hart retired from the direction of the chemistry department in 1916, he has retained the title of professor of chemical engineering and he has completed a round fifty years of service as a teacher.

Dr. Hart possesses great originality together with boundless energy; but modesty in regard to his own attainments and kindliness are even more characteristic of his later years. Still working on important industrial problems, such as the recovery of potash from greensand, much of his time is given to civic work and to the improvement of the farm which he has recently developed.

Dr. Hart was for two years a member of the Common Council of Easton and a member of the Highway Committee. He has been chairman of the Easton City Planning Commission since 1906. He has been three times president of the Northampton County Historical Society. He has been president of the Easton Motor Association, trustee of the Easton Board of Trade, and in 1912 he was candidate for Congress on the Progressive ticket. Although a practical printer, he advocates the use of the metric system in printing.

Along with his other work Dr. Hart has written several textbooks and considerable verse of a humorous or sentimental character. His description of "The Hobo" is certainly not autobiographical:

I think some evil molecules
  Must in my system lurk
I really am not lazy
  I just don't like to work.

Program of the Edward Hart Celebration and Intersectional Meeting

Under the auspices of the Lehigh Valley Section, the New York Section, the Philadelphia Section, the Wilmington Section, and the South Jersey Section of the American Chemical Society.

October 16, 17 and 18th

Thursday—

9:00 A.M. Gayley Chemical and Metallurgical Laboratory, Registration

10:30 A.M. Colton Memorial Chapel, Founders' Day Exercises, One-Hundredth Anniversary of the Founding of Lafayette College

2:30 P.M. Pardee Auditorium. General Theme: "Fifty Years of Chemistry in America." Speakers: Dr. Edgar F. Smith, Dr. Harvey W. Wiley, Dr. William H. Nichols, and Dr. Bradley Stoughton

5:00 P.M. Reception and Tea. Residence of Dr. and Mrs. Edward Hart, College Campus

7:00 P.M. Banquet at Northampton Country Club, in honor of Dr. Hart. Ladies are invited

Friday—

9:30 A.M. Pardee Auditorium, Plasticity Symposium.

2:00 P.M. Plasticity Symposium (Continued)

Saturday—

9:00 A.M. Excursions to points of interest in the Lehigh Valley:—

1. Martin's Creek, Bangor and Delaware Water Gap.
2. Easton and Phillipsburg plants.
3. Lehigh University and the Bethlehem Steel Co.
4. The New Jersey Zinc Co. Research Laboratory and Plant.

M. E. HOLMES AT COLUMBUS STATION

Major E. Holmes, recently has joined the staff of the ceramic station, U. S. Bureau of Mines, at Columbus, Ohio. Dr. Holmes will have charge of the work which the Bureau is doing in coöperation with the Dolomite Products Company of Cleveland, Ohio. Dr. Holmes brings to this work a wide experience gained in the lime and gypsum fields.

BUREAU OF MINES NOTES

Zinc Refractory Research

The Bureau of Mines is starting a survey of the conditions under which zinc refractories must give service. The field work is being carried out simultaneously with a survey of the fuel economy problem. Messrs. Brewer and Rice are in the field surveying the conditions which obtain at retorting plants in the tri-state and St. Louis districts.

Mr. Keuchler at the Rolla Station is carrying on fundamental research into properties (*a*) of zinc retorts now in use, (*b*) raw materials used in their manufacture. The purpose of the investigation is to develop a better refractory for the service or to so modify the process as to lengthen the life of the refractory now in use.

Power Plant Refractories Survey

A coöperative agreement has been made between the Department of the Interior and C. A. Hirshfield of Detroit, representing a group of large central power plant operators, to make a survey of present conditions relating to the use of power plant refractories. The survey will be conducted by engineers of the Bureau of Mines.

With the present high ratings at which boiler plants are being operated and the increasing use of pulverized coal with its attending high temperatures, the refractories now available for lining boiler furnaces are proving inadequate. In this survey a study

is being made of the characteristics of refractories now available for use in power-plant boiler furnaces, and the conditions under which they are used, their life in operating practice under the conditions prevailing at different plants and the way in which the refractories now marketed fail to meet these conditions. The purpose of the survey is to obtain fundamental data to be used in bettering refractory service.

DEPARTMENT OF COMMERCE NOTES

Ceramic Whiting Specification

July 25, 1924

The desirable qualities of ceramic whiting, used in the manufacture of glazes, enamels, and other ceramic products, are given in a specification for this material recently issued by the Bureau of Standards. It is recommended that the material should contain not less than 97% of calcium carbonate and should be very fine, so that 98% of it will pass a No. 200 screen.

This is the 5th of a series of specifications issued by the Bureau for the kinds of lime required by different chemical industries. The preceding 4 dealt respectively with lime for use in cooking rags, in causticizing, and in the manufacture of sulphite pulp and of glass. They were prepared under the direction of the Interdepartmental Conference on Chemical Lime, composed of representatives of the Bureau of Standards, the Geological Survey, the Bureau of Mines, the Department of Agriculture, and the Chemical Warfare Service.

The specification is given in Circular No. 152 of the Bureau of Standards entitled "Recommended Specification for Ceramic Whiting." Copies can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 5 cents, cash.

Make Sweeping Reduction in Restaurant and Cafeteria Chinaware

Reduction of varieties and sizes of restaurant and cafeteria chinaware from 66 items to 176 will become effective before the first of next year, as a result of action taken by the Board of Directors of the National Restaurant Association at the association's convention in Chicago recently, according to a report to Ray M. Hudson, chief of the Division of Simplified Practice, by H. Ross Colwell of the Division, who has been working on the simplification of these items. There were 16 more items on the list retained by the retaurant and cafeteria interests than on the list of the hotel industry after the latter had simplified its variety.

The 492 eliminations recommended by a joint meeting of committees of manufacturers, distributors and users will take effect about the first of the year; though Mr. Colwell reported that certain potteries manufacturers are issuing "standard" lists with marked inducements in prices for such lists.

Three committees have been appointed, representing the manufacturers, distributors and consumers and their allied interests. These will meet on September 3 at a morning session, in conference with H. Ross Colwell of the Division of Simplified Practice, who will be speaker at the afternoon meeting of the convention.

The manufacturers' committee comprises C. W. Read of the Shenango Pottery Company of New Castle, Pa.; E. L. Tolbert of the Onondaga Pottery Company of Syracuse, N. Y., and D. W. Scammell of the Scammell China Company of Trenton, N. J. The membership of the committee representing the distributors includes Arthur Nason

Howe of Mitchell Woodbury Company, Boston, Mass.; L. Barth & Son of New York City; Albert Pick & Co., Chicago; The Straus Company of Richmond, Va.; and the Dohrmann Commercial Company of San Francisco, Calif. Representing the consumer interests is a committee comprising Harry S. Baldwin of Springfield, Mass.; Nate W. Stone of the Hippodrome Inn., Cleveland, O.; Frank Knapp of McCreary & Co., Pittsburgh, Pa.; Allan Pollok, president of the American Association of Dining Car Superintendents, San Francisco, Calif.; Horace Boos of Boos Brothers Cafeteria Co., Los Angeles, Calif.; W. I. Hamilton, director of research of the American Hotel Association, Chicago, Ill.; and a representative of the American Telegraph and Telephone Co., New York City. A. B. Carder of Los Angeles, Calif., is secretary of the Association.

These committees, following separate meetings, will hold a joint session, at which will be determined the recommendations to be reported to the convention.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	Oct. 6–7, 1924	Los Angeles, Calif. Hotel Biltmore
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924–Jan. 3, 1925	Washington, D. C.
Am. Assn. of Flint and Lime Glass Mfrs. (Quarterly Meeting)	Oct., 1924	Pittsburgh, Pa.
Am. Assn. of Flint and Lime Glass Mfrs. (Annual Meeting)	July, 1925	Atlantic City, N. J.
Am. Concrete Institute	Feb. 24–27, 1925	Chicago, Ill.
Am. Electrochemical Society	Oct. 2–4, 1924	Detroit, Mich.
Am. Engineering Council (Administrative Board)	Oct. 17–18, 1924	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
Am. Foundrymen's Assn.	Oct. 11–16, 1924	Milwaukee, Wis.
Am. Gas Assn.	Oct. 13–17, 1924	Atlantic City, N. J.
The American Institute	Dec., 1924	New York City
Am. Inst. of Chemical Engrs.	Dec. 3–6, 1924	Pittsburgh, Pa.
Am. Inst. of Min. & Met. Engrs.	Oct. 13–15, 1924	Birmingham, Ala.
Am. Mining Congress	Sept. 29–Oct. 4, 1924	Sacramento, Calif.
Am. Society of Mech. Engrs.	Dec. 1–4, 1924	New York City
Common Brick Mfrs. Assn.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Edward Hart Celebration and Intersectional Meeting	Oct. 16, 17, 18, 1924	Easton, Pa.
Exposition of Inventions	Dec. 8–13, 1924	New York City
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Management Week (Auspices of Am. Soc. of Mech. Engrs.)	Oct. 20–25, 1924	New York City
Manufacturing Chemists' Assn.	June, 1925	New York City
Mining & Met. Society of America	Jan. 13, 1925	New York City
Natl. Academy of Sciences	Nov. 10–12, 1924	Cambridge, Mass.

Organization	Date	Place
Natl. Assn. of Mfrs.	May, 1925	New York City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Exposition of Power & Mech. Engr.	Dec. 1–6, 1924	New York City
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Lime Assn.	May, 1925 (?)	
Natl. Safety Council	Sept. 29–Oct. 3, 1924	Louisville, Ky.
N. J. Clayworkers' Assn. and E. Sect. of the American Ceramic Society	Dec., 1924	New Brunswick, N. J.
Optical Society of America	Oct. 23–25, 1924	Boston, Mass.
Refractories Mfrs. Assn.	Oct. 3, 1924	Pittsburgh, Pa.
Society of Chemical Industry	Oct. 17, 1924	New York City
Society of Glass Technology	Oct. 15, 1924	Sheffield, Eng.
Taylor Society	Dec. 4–6, 1924	New York City
Tenth Exposition of Chem. Industries	Sept. 28–Oct. 3, 1925	New York City
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Mfrs. Assn.	Jan., 1925	Kansas City, Mo.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Vol. 3 November, 1924 No. 11

EDITORIAL

YOUTH MAY SERVE

Seymour Parker Gilbert, Jr., the thirty-two year old fiscal genius, was recently appointed Agent-General for Reparations. Alexander Hamilton retired as Secretary of the Treasury at the age of thirty-eight. Two remarkable men, these, and not at all representative of the average. These and the many other well-known young men of large affairs who have won recognition not by wealth, family or fate but by might of personality, mental resourcefulness and hard work prove that age is not the determining factor in professional preferment. Youth need not hesitate. Youth may obtain a commanding position by qualifying as one capable of rendering service.

Gilbert has been made Agent-General for Reparations because he can deal with men straight and convincingly; because he can see and evaluate clearly both the causes and their effects; because he knows how and where to obtain information and also (and this is the point we wish to emphasize) because he worked many unscheduled hours alone.

Eight hours a day has not been Gilbert's schedule for work nor has it been for any other successful young man. No man has earned recognition and a place in affairs by mere possession of talents. Success is attained by continuous systematic work.

Many of our college graduates devote too little time outside of their

scheduled factory hours in a searching study of the science in which they wish to gain recognition as experts. To too many the "burning of midnight oil" for self-advancement in their chosen profession is not a habit nor a practice.

Social intercourse and an interest in community affairs is excellent mental recreation and a means of developing personality and ability to deal with men broadly but to devote eight of every twenty-four hours to such activities is not leaving enough time for self-advancement in one's chosen profession.

Eight of each of the twenty-four hours belong to the employer. To whom do the other sixteen belong? Our physical being requires eight of these for rest and refreshment. What portion of the other eight shall be used for self-betterment in the profession in which a livelihood is to be earned?

The college graduate has a greater need and should feel a larger urge to "burn midnight oil" in study than any other industrial worker for in no other wise can he qualify for a foremost professional ranking, and in no other wise can he meet the expectation of either his employer and industrial associates or of himself and family.

Young men will have large industrial opportunities and responsibilities if they qualify and no young man can qualify except by proper use of the eight hours which are his each day. Industrial preferment and the remuneration and pleasure which follow can be secured in no other wise.

The prime purpose of the AMERICAN CERAMIC SOCIETY is to encourage and to plan for the most profitable use of that third of each one's time which is his in which to make himself better qualified as a ceramic worker. This opportunity rapidly decreases as age advances. It belongs to youth.

PAPERS AND DISCUSSIONS

COMPARATIVE SERVICE TESTS OF GROSS ALMERODE AND DOMESTIC CLAY POTS[1]

By Warren S. Williams

ABSTRACT

Glass-drawing pots made from Gross Almerode clay proved to be superior in a service test to pots made from a synthetic siliceous domestic clay mixture. When removed from service the faces of the Gross Almerode pots are pitted. The faces of domestic clay pots are surface cracked. The blistering of the glass caused by this cracking is eliminated by substituting silica brick grog for fire clay grog.

Introduction

Clay from the Gross Almerode mines of Germany has been used by glass refractories manufacturers for years. In fact, before the war, many manufacturers in America used this imported clay exclusively. During the war, they were forced to substitute domestic clays and some manufacturers have returned again to its use after the war. The characteristics and working qualities of this clay are of considerable interest to the industry because of its wide application in glass refractories manufacture.

Gross Almerode clay is now received in casks weighing approximately 1000 pounds. It is light gray in color and has been washed and is received in nut size lumps. These break up easily in a dry pan into a very fine dust. When mixed with water it is sticky, but not tough nor very plastic to the feel of the hand. This sticky quality gives the clay a ready bond without much danger from laminations while molding it into pots.

For pot making, the clay is mixed with 60% of grog which permits the pots to be dried rapidly and safely. Drying conditions must, indeed, be very severe to disrupt the bond of this open porous clay. In the dried state, the pot batch, using 40% raw clay and 60% of grog, is comparatively weak. The dry modulus of rupture of this mixture is given in Table I.

Table I

	Modulus of Rupture Dry	Burned
German Mix	134	654
Synthetic Mix	223	825

Screen Analysis of Grog Used in German Mix

	Mesh	Per cent
Retained on	10	21
Retained on	20	26
Retained on	40	24
Retained on	60	12
Retained on	80	2
Through	80	15

[1] Presented at the Atlantic City Meeting, February, 1924 (Glass Division).

It is sufficiently strong to permit lifting the pots shown in this *Journal*[1] by the lugs. When burnt to cone 3, the pots are a light buff color and are strong enough to bear their own weight, plus the weight of the glass, when suspended by their lugs.

The test bars for the burnt modulus given in Table I were burned in the same pot arches as the pots themselves, taking about seven days to reach cone 3. Both dry and burnt modulus are the average of over 150 bars made at differing times and burnt in several different pot arches. The screen analysis of the grog used in these test bars is also presented.

The chemical analysis and physical properties of the German clay now being received correspond closely with that given by Bleininger.[2]

Various attempts have been made to duplicate the service obtained from glass-drawing pots made of German clay by substituting synthetic domestic clay mixtures. One of these mixtures was obtained from a large glass refractories manufacturer, pugged, aged and ready to use. Judging by appearance, the grog size was apparently the same as that used in the German clay batches with which they were compared. The transverse strength, as given in Table I, is stronger than the Gross Almerode and the synthetic mixture, also, proved to be superior in the quenching test. The porosity-volume shrinkage curve closely approximates the foreign clay. The residue left on a 100-mesh screen after washing, plainly shows the addition of fine sand to increase the silica content.

The method employed in comparing pots made from the synthetic mix with the German clay pots was to set them in the same pot arch at the same time. Nine pots are set in an arch, four of which were synthetic, sandwiched alternately between five German. By this setting, the pots were burned to the same temperature, used at the same tank during the same period, and under like conditions. A fair comparison is thus obtained. Eleven pot arches were set in this manner with the following results:

48—Pots of synthetic clay served 607 days; average 12.6 days.
54—Pots of German clay served 1058 days; average 19.6 days.

Chemical analyses of both clay mixes burned, follow:

	Burnt German	Burnt synthetic
Silica	77.48	72.34
Alumina	18.00	22.40
Titanic acid	2.48	1.56
Iron	.88	2.00
Lime and magnesia	.55	.52
Alkalies	.52	1.14

[1] W. S. Williams, *Jour. Amer. Ceram. Soc.*, **6** [11], 1148 (1923).
[2] Bur. Stand., *Tech. Paper* **144**.

The free silica in the German clay has been identified by an experienced petrographer to be very fine grained quartz. This quartz requires elutriation to separate it from the clay substance.

The characteristic difference in the appearance of the German pots and those made of various domestic clays, after they are removed from service, is the absence of "turtle-back" cracking in the bottom of the German clay pots. This is apparently due to the more soluble nature of the foreign clay. The glass seemingly dissolves the surface of the pot at approximately the same rate at which the fine cracks are formed. The outside surface of the pot, not in contact with the glass, exhibits the "turtle-back" cracking in like manner to the domestic pots.

After a week's service, the German pots exhibit a uniformly pitted surface like small-pox marks. If the slope from the tops to the bottoms of the pits is gradual, the pits do not affect the cylinder of glass. If the slope is abrupt, air is entrapped in the pit while draining the pot. The expansion of this air, when glass is again ladled into the pot, forms blisters or seeds in the glass. This blistering effect in the domestic clay pots, due to entrapped air in the "turtle-back" cracks, was the cause of removing from service over 90% of all domestic clay pots.

GLENDALE, CALIF.

Discussion

W. S. WILLIAMS: Actual service tests over a long period of years have demonstrated the superiority of the refractories made by the Pittsburgh Plate Glass Company in many branches of the glass industry. Its application in the service herein described is restricted to only one service in one branch of the industry. The fact that it failed herein seems to prove its superiority over the German clay, for other glass refractories prevent blistering from the "turtle-back" cracks. This resistance to corrosion without stones would be strongly in favor of the synthetic batch in other applications such as tank block, plate glass and flint glass pots, rings, boots, floaters, etc.

C. E. FULTON: I believe the pots referred to by Mr. Williams are the reversible pots used in the American Window Glass cylinder process. It is possible that the so-called synthetic mixture is used in making pots for melting plate glass. If so, it is a combination of domestic clays which for plate glass purposes gives better results than German clay batches. However, the grinding is considerably finer than that given in the paper for the German clay pots. In fact with the domestic batch there would be practically no residue on the 10-mesh screen so that the difference in results would not be due entirely to the use of German clay.

MR. PAYNE: In other words you would not say that the domestic pots were better than the others?

C. E. Fulton: He shows that the German clay pots gave better results in this particular test, but the point which I want to bring out is that the comparison is unfair to the domestic clays in that the chief defect of the domestic pots was cracking which in a large part could be attributed to the fineness of grinding.

Mr. Payne: Of course, during the war we used very little German clay and I guess this was the case with the paint manufacturers. After the war some used it and some did not; some advertised that they were again using German clay and some advertised that they did not and would not again use it. Are there any tank block manufacturers here who would care to say that they are using the German clay?

Mr. Aurien: I recall that our company probably 18 or 20 years ago imported German pot clay. Why it was ever discontinued I do not know but I do know that in the past 16 or 18 years we have not used any German pot clay. I know it was the contention at one time that one had to have German pot clay to make a block good, but I guess this theory has been disproved.

Mr. Brownlee: We are now using German pot clay.

Mr. Montgomery: We do not use any German pot clay in the pot used in the manufacture of optical glass.

Mr. Dixon: A number of years ago I was in the pot business and we had quite an experience with these various clays. We were in the business when Missouri clay was first discovered and brought into use for making pots. In those days we had to depend entirely upon German or English Stonebridge clays. The pots made of that clay answered the purpose admirably during the time of the use of such crude furnaces. The furnaces then were most all of the same character as bucket furnaces, not hot running gas furnaces such as we employ today.

I remember very well at that time we had a standing order from the Corning Glass Co. for 100 pots to be kept on hand all the time and also from the Old Meriden Glass Co. of Meriden, Conn. and from the New Bedford Glass Co. They all made a very rich lead glass. The pots were designed especially for this glass. When the Missouri and other domestic clays came into use we attempted to use them for this purpose but we could not make them stand the erosion from that rich lead glass. The German clay pots would stand it and the domestic clay pots would not without causing stones. The pots had to be made of a special mixture. German clay was used almost exclusively. Now, as time went on they improved the furnaces. Instead of making 2 or $2^1/_2$ melts a week they got to making 3 and $3^1/_2$ and 4 and $4^1/_2$, and the pots made of either Stonebridge or German clay would not stand it. They would melt down or bridge out of shape. We had to overcome that result by finding some material that was more refractory to mix with it. The Missouri pot clay met this requirement.

Now the proper mixture of these met the two conditions; it stood the intense heat of the furnace and the pots stood up well, and the mixture of the German clay made them wear better. Invariably if we would leave the German clay out for any reason the pots would not wear as well, and if we would leave out the Missouri clay the pots would not stand up.

Then we came along to the time when we were making a certain grade of lime glass, running intensely hot furnaces, building very large pots that held from 3600 to 4000 pounds to be melted in 24 hours. The pots had to stand severe service. These pots were made entirely of Missouri and other domestic clays; no German pot clay in them.

That was a development of our experience in making pots to meet those various conditions. When tank blocks came into use in this country naturally the block manufacturers followed the same practice. They had to make a block that would stand the erosion of the alkalis used in glass and they had to make a block that would stand the heat. They mixed the two clays together. Some have not done so, and strange to say the success of all of them has been about equal. I could not say today whose blocks are best. We use them all. I do not think anybody else can because the furnaces and operating conditions vary so much.

Mr. Williams: As I remember A. V. Bleininger attempted to find the actual properties of the German clay which made it so desirable and then tried to reproduce those properties with American clay. As I recall the result obtained was quite similar. He blended several American clays rather than using any single clay and not wholly those which are commonly known as fire clays. He used kaolins and ball clays in part substitution for the Missouri and Pennsylvania fire clays. As nearly as we could see the life or tendency to corrode in the pots was improved.

I can speak more positively regarding the optical glass melting. We could not use an ordinary fire clay pot from the standpoint of color alone but from the standpoint of corrosion. We found with the heavy lead and the 30% barium glasses which were exceedingly corrosive that just one melt alone would go through fire clay pots. The pots made with kaolins and ball clays could be reused.

WHAT HAS BEEN THE EXPERIENCE IN SUBSTITUTING DOMESTIC SECONDARY AND PRIMARY KAOLINS FOR ENGLISH CHINA CLAYS?[1]

By Karl Langenbeck

ABSTRACT

The duty of the U. S. Tariff Commission with respect to ascertaining if the rates of import on foreign clays are bringing about freedom of commercial competition in domestic clay.

[1] Presented at Atlantic City Meeting, Feb., 1924 (Whitewares Division).

Two instances, in the manufacture of electrical porcelain, were brought out, in which the consumers buy foreign or domestic china and ball clays, in which competition is free. That is to say, experience with competitive clays is sufficiently complete to enable all purchases to be made on the basis of price, f.o.b. factory.

The factor of uniformity in deliveries, brought out indictment of domestic china clays and English ball clays, as irregular in quality.

The inadequacy of analytical and experimental methods and practices, in failing to give comparable data, as between clays similar in kind, was charged by all producers. No defense to the charge was made by any ceramist present.

The claimants of the electrical porcelain industry, of experience enabling them to substitute competitive clays for each other, gave no information on the character and limits of their tests.

As there was manifest lack of progress in the testing of clays, that would lead to safe subsitution, the failure of free competition between foreign and domestic production does not lie in the economic field. It must be charged to the ceramic profession as a whole.

Introduction

What the Tariff Commission Is

I may mention in instigating inquiry on substituting domestic secondary and primary kaolins for English china clays, that I have been connected with the United States Tariff Commission for the past two years, organizing what was known as Schedule 2, which relates to the non-metallic minerals, cements, pottery and glass, and the raw materials which go into them.

Under the present Tariff Act, which is distinguished from previous ones, you may have heard that it embodies flexible provisions, so called. The idea is that in the hurly-burly of constructing a new Tariff Act, it has been the experience of Congress that they get from the parties that are vitally interested, information on the subject, and often very pertinent information does not reach them from the public at large or from those concerns that are not strong enough to send representatives to Congress. In the vast amount of business which a Congress always has to enact, there is scarcely time to thresh out questions thoroughly. And then statistics and information which are brought to Congress, while undoubtedly honestly given, naturally have a human bias.

Therefore, Congress, in passing the present Tariff Act, envisaged this provision entirely aside from party considerations.

We know, of course, in a general way that the strength of the Democratic Party lay in its traditions from the old division of the country, and that the South, where the strength of the Democratic Party has continued, was in the early days, interested in producing raw materials. The Republican Party in the North was interested in developing its economic system which was to endeavor to make the country self-contained and bring up manufacturers so that there would be employment for all types of labor and for all aptitudes and interests of the human mind.

Now the country has become more homogeneous. Manufacturers are increasing by leaps and bounds in the stronghold of the Democratic Party, and I think it is the general feeling of the two parties that if they can, in fact, if not in theory, come together on one idea, it is this. The conditions of American living are such that we have higher standards than they are accustomed to in Europe. We have better working conditions and better hours, and no matter how anxious the management of a factory may be to make both ends meet—and its constant problem is the high cost of labor—yet there is the feeling with the manufacturer who is hard pinched, that we do not want to lower the standard of living for all classes in the country because the workmen of the country are large buyers and these things interact, and if we reduce the prosperity of the workman, we reduce his buying power.

Both parties, therefore, are really agreed that the standard of living of the country must be maintained. That being the case, the expedient of a protective tariff, is favored by all parties.

However, the question arises—as there always are qualitative considerations and quantitative ones—"How much?" And Congress has therefore said, "We may not have fixed in the last Tariff Act the right duties. We have not had the facts before us. We may have exercised poor judgment. We may have been carried off our feet by plausible gentlemen who have known how to work us for high protective duty. We want to know."

We, therefore, give the President the power to alter these rates of duty to the extent of 50%, either up or down, on the application of any citizen of the country, whether he be a consumer, a producer or an importer. It is immaterial. They are all citizens of the United States and they are entitled to question. It is then the duty of the Tariff Commission to find out what is the actual cost of production and whether the tariff rates equalize these costs of production, and make their recommendations in accordance with that to the President. The President is then empowered to raise or lower the rates.

You can understand from that that the Tariff Commission has large responsibilities, and it also has mandatory powers to ask the most searching questions of the individual manufacturers.

The idea is not to get the cost of production of an extremely well-organized factory which is financially strong and which can get the best conditions of equipment and labor and that sort of thing, and base the costs of production upon such data of a few outstanding factories. But it is to protect, in industry, the man who is less strong, who has struggled along for years, who has had hard work in meeting his payroll, who cannot take advantage of modern appliances and technical help. He is also an American producer and he is entitled to consideration.

Therefore, we have to get these costs of production as widely as possible from individuals because that is the only place to get them. What we ask is very searching and we give the manufacturers individually the assurance that whatever they send us is absolutely inviolate. We also give the same assurance to the importer in order to get the costs of production by the foreign producer.

If the results justify a revision of the Tariff, only the average is used. In other words, what we have to find out are the costs of production in the industry, not of the individual. The average of the industry can, of course, only be obtained from the information of the individuals. Nothing is given to the public. The public is not even informed whether any inquiry is made until the Tariff Commission decides that the question is subject to inquiry, and after an application has been made to inquire into the subject. Then, in many cases, it is turned down as being inadequate.

But if there is cause, and anything is published it is only this average representing the industry which is published. Even then nothing is done arbitrarily, because public notice is given that there will be a public hearing. There may be economic questions enter into the question that we experts have not been able to ferret out or get the true light on. We have a court room and thirty days' notice is given, and both sides, the foreign producer and his representative, or the importer and producer in this country, can meet face to face and thresh the matter out before the six Tariff Commissioners who sit in the tribunal as the judges.

I think it important that you should know what this coördinate branch of the government is and what its purposes are. If inquiries about any of your commodities should come to your firm, your office may not know what it is for, and you should have direct information by word of mouth as to what the duties of the Tariff Commission are. You can have all confidence that whatever is asked will be for purposes of the Commission only, and will be held inviolate.

It is our business to get just as much information as we can on all of the commodities in our schedule. We send out to get information even if there is no question at all from any party about the particular commodity.

Inquiries on Ceramic Materials

We have had to make inquiries about cement, about common brick, about china clays and ball clays, about the various kinds of manufactures of clay wares and the various manufactures of glass, going even to fine microscopes and telescopes, because they are also in the schedule.

I do not want you to think that I have an encyclopedic mind, but we have to accomplish these things with the aid of our assistants as well as we can.

As something of importance and interest to the Ceramic Division, I sent in a question about china clays. If somebody had questioned it, I would not tell you for I have no right to do so. I am just getting general information, and I thought this would be a great opportunity. The importers of clay would meet here face to face, the producers of our domestic clays would be here, and the technical men who have had experience with one or the other, or both, and you could give candid expression to your views in the face of all interested parties.

You may remember that with the entry of the country into the Great War, the question of keeping open the ocean lanes was a very serious one, indeed. One of the questions that was put to the Bureau of Standards was: Are we going to be able to get English china clay, this product which has become standard for the United States, at least standard as a reference material and a material of use in fine products? Is the production of the country going to be injured during the war period by the cutting off by German submarines or what-not or the demand for more remunerative shipping, from the flow of the English china clay which has come to this country for so many years and in such a large tonnage?

The Bureau of Standards worked on this problem of the use of domestic clays in substitution for the English china clays so that indeed the pottery manufacturer, as well as the paper maker, would have something to turn to.

A. V. Bleininger was particularly engaged in the interests of that work among his other duties, and he reasoned that there are residuary kaolins occurring in our country in the mountainous regions of the Alleghenies which have been exploited to a material extent in western North Carolina. They exist north of there up toward the Potomac, and even further than that, where the mountains have disappeared in Delaware, through spots in Maryland and so on.

There are also the great clay deposits in the coastal region of the South, in South Carolina and in Georgia. These are the secondary kaolins, so called, because while they originated as residuary kaolins first, in the mountainous regions, they were carried down by streams and deposited possibly in lakes and swamps of the seacoasts of an older geological period.

As you know, this moving of a clay by a water body has resulted, through hydrolysis, in making a material that is a white material where it was fortuitously saved from admixture with surface soils in making a material that is more plastic, the plasticity being often astonishingly large, as in the case of those moved as far as the lakes and swamps in northern Florida.

Then Mr. Bleininger envisaged the fact that with the non-plastic residuary clays that we have in the mountain regions, and with the great manipulation that the sedimentary clays received in the Coastal Plain,

we have two products that differ from the English china clays in this, that while the English china clays are residuary clays, they have apparently been subjected to hydrolysis, not to the extent of our southeastern kaolins, but to some extent. So that the English china clays have less plasticity than our secondary clays, and more plasticity than our primary clays. They have retention in paper fiber and so on.

It seemed reasonable, therefore, that the domestic product could be prepared by the use of our two classes of china clays in which the residuary clay plays the part of holding up the body well, so that in the fire it does not sag or shrink, and that it would counteract the excessive shrinkage and the cracking of too plastic clays which might occur with the sole use of the secondary clays. And in that way, the equivalent of the English china clay could be produced.

A good many of the pottery manufacturers were induced to make experiments. Many of those whose conditions are not as strenuous as those who manufacture table ware, introduced domestic clays in this way.

The question that we in the Tariff Commission have to answer is: Why is it that with the duty on English china clay so high our domestic producers are careless in their manufacture? Are the conditions of labor getting to be such that they have to look to a machine shovel proposition and cannot go to refinement, that the English manufacturers do with the greater command of hand labor? Are they justified, therefore, in producing clays that are accused of not being as good in grade? Can they or can they not be depended upon, and what is the outlook of the industry?

These are the questions that I want to put before you and would like to hear discussed from all sides, for they have a general bearing upon the question of our domestic product.

It goes without saying that if we want the country self-contained by protecting manufacturers, we also want to be self-contained in the matter of producing and using its raw materials. But we do not want manufacturers to take unnecessary risks in the use of those raw materials if the producers of them cannot be induced to produce them right and to give them, as they need it, a product upon which they can depend.

We have large deposits of primary and secondary kaolins in this country and so far as the policy of the country is concerned for those that wish to encourage American industry, and also in the matter of common sense, it will be desirable to make the United States self-contained as far as possible or practicable. For that, all of the interests have to work together.

Inasmuch as the Government made an earnest effort during the war, through the Bureau of Standards, to find out how far, in a case of emergency our country would be self-contained in this raw material, we want to know what progress has been made, whether the domestic producers are on firm

ground, and whether they are defeated by the possible prejudices of long standing.

As the importers are citizens of the United States who have the equal right and protection of our laws it would seem desirable to bring out what progress has been made.

How far can we depend on our domestic product? How far are we really dependent on importations? We should like to hear from the men who are interested in both sides and aspects of the clay industry and furnish the supplies. What have they to say, what has been the experience of technical men and what has been the experience of business men who bring in commercial questions in connection with the matter?

Discussion

MR. RUSOFF: I have had considerable experience with North Carolina clays. In former days, we had little trouble in getting the right quality of North Carolina clays, but in the past few years, due to the tremendous demand upon the clays of which I speak, there has been no question in my mind that the quality of clay has deteriorated to a great extent due to the fact that the pits are being rapidly exhausted and that they may be compelled to turn out a poor product owing to the increased production.

I have had high content of moisture in regard to North Carolina clays and the same in reference to ball clays. One man told me, "The water is mighty good down here. It is better than the water up in your section." For that reason he thought it worth while to keep as much moisture in as he did.

I always felt that 12% moisture was more than sufficient for china clays but I have seen carloads from time to time with as high as 18% and 22% moisture. On top of that, you will oftentimes find a great quantity of mica even on a 200-mesh screen, and also a considerable quantity of iron scale, possibly off their coils in their drying sheds.

I think one thing that the North Carolina producer is going to realize is that he will have to put out a much better product than in the past. This production craze is not going to last and the quality is going to be the big consideration in the next few years.

CHAIRMAN RIDDLE: One of the men just spoke of some of the English clay miners showing our literature and stating that in view of the fact that the CERAMIC SOCIETY said we need English clays they could keep their prices up.

There is one thing for all of us to bear in mind. No matter who states these things as facts and who reads these discussions (that is, someone on the outside) we must always remember to tell them that these are the opinions of the individuals and you will find in the SOCIETY literature

the statement that the SOCIETY is not responsible for the statements made in the *Journal.* Those are the opinions of the individuals themselves. No matter what is said, that argument always holds good, if anybody is trying to use it as a club.

MR. BELL: The Mandle Clay Mining Company which I am associated with mine only ball, wad and sagger clays; that is to say, we do not produce china clays. While we feel that many who are now using the imported ball clays could use our materials to advantage we do not attribute this to any prejudice against our clays. We find the users always perfectly willing to make tests of our clays. We could not ask any more than that. However, in many cases where our clay is not adopted, after tests are made, we believe it is due to the manner in which trials are made. Of course, each factory manager has his own idea about how this should be done.

We cannot make the clay over and have to offer what we find. We select our clays carefully and do not make any mixtures of them. This gives as uniform a selection as can be had by mining each strata separately and by removing visible impurities which are large enough to justify taking out by hand. We believe that any variation in a clay strata could be detected by the eye, though we watch the matter carefully by having numerous trials made throughout the year of each clay we are mining. We believe we are producing very standard selections for we have been selling the same lines for many years. It is reasonable to assume that our trade finds no difficulty on the score of standardization.

Since and during the war we have sold larger quantities of ball clay than before. During the war we were able to place our clays in lines where before it seemed impossible to do so, and since adopting them many have continued their use. There are certain manufacturers using our ball clays exclusively, whereas others making the same line are using only imported ball clays. Others use some of each; thus it seems by fixing the right combination the domestic clays can be used satisfactorily in place of the imported.

We have no complaint on the reception of our clay by the trade, for the increasing demand indicates that our clays are proving satisfactory and we are pleased to be able to assure our customers a continuous supply of our present selections for years to come.

As to the tariff, I wish to say that I do not believe it would help us any in selling our clays unless it should be increased so as to make the imported clays more or less prohibitive. This would require a tariff rate which probably would be considered unreasonable while a low tariff on imported clays would not benefit the domestic producer any and would only impose that much on the customer. There has not been, as far as I know, any concerted action on the part of the domestic producers to get a tariff on imported clays.

Dr. Langenbeck: While Mr. Bell has spoken of ball clays the principle we are after would equally apply to all ball clays and china clays. He touched lightly on the technical point of his clays gaining a foothold and the progress that is being made, but whether that progress is fast enough or not fast enough, is something that seems to me the technical men here should answer. And as I say, I think indirectly that would apply also to the china clay question which is more immediately before us.

Perhaps the Chairman, therefore,[1] will make an appeal to the technical men who have had experience with English ball clays and American ball clays, and who can give reasons why the substitution of the American ball clays is not greater than it is, and whether the slow progress is justified.

Further, it seems to me, it would be of interest to the technical men who are present to speak frankly on a subject like this, because in so conservative a craft as the pottery industry all sorts of minor considerations often thwart a technical man. He ought to have one place where he can open his heart with reference to his profession and probably it will react upon his industry.

Chairman Riddle: Are we paying for ball clays at a price varying in proportion to the bonding power of the clays? And if so, do these tensile strength tests in the raw state pretty well govern the price?

As I understand it, a good many of the English ball clays are considered very strong, and a less amount of them, as a result, is used in the body. If that is so it is one way of approaching the subject.

Dr. Schramm: I have had no experience in the use of American ball clays in vitrified ware. We have always used English ball clays.

We have a fixed policy not to change any material unless we can show an improvement in our product as a result therefrom.

Mr. Crane: I have heard you use the word "ball clays" here. I have asked those who use clay what is ball clay? And I have never yet had a definition I could understand.

Mr. Brian: Ball clay derived its name from the fact that the clay when mined comes out in lumps or in balls, therefore, the English definition for it is ball clay. As the clay is mined it is mixed containing various colors. You can easily count as many as fifteen to twenty colors in the average English ball clay mine excluding, of course, some of the ball clay mines from which the extremely dark clay is produced. This clay will run dark along with some very light colored clay. The light colored clay is weaker in tensile strength than the dark clay.

Prof. Watts: In surveying the English versus the American ball clay, my impression is that the English ball clay has by many potters been

[1] A. S. Watts, "Ball Clay Specifications," *Bull. Amer. Ceram. Soc.*, **3** [8], 288(1924).

considered more desirable because it begins to vitrify at a lower temperature than the American ball clay, and that it has an improved working property which it imparts into the body over that possessed by the American ball clay. Whether that is the property by which lubrication is imparted, or the property by which increased bonding strength is imparted, or whether it is the combination of the two which particularly adapts it for use in the whiteware body, I am not able to say.

But the answer which I have received from almost every whiteware manufacturer who is wedded to the English clay, is to the effect that he finds that the body has a certain working property when he uses the English clay which he cannot obtain by the substitution of the American ball clay.

No two clays possess the same physical characteristics. They may be identically the same so far as we can determine by chemical analysis, but each possesses an individuality and the man who has been accustomed to working a body with English ball clay in it, notices a distinct change when American ball clay is substituted.

On the other hand I have found many manufacturers who say that they have found that they can substitute a certain amount of American ball clay, and get equally good results. Some of them say they have to use slightly more than they did with the English ball clay; others say that they do not believe that the color that they obtain when they use American ball clay is quite as good as the color they obtained when they used English ball clay.

But within the last two or three years, I have had a great many users of English ball clay say to me that if there is any American ball clay that is any dirtier or any more unreliable than some of the English ball clay, they were unable to locate it.

I believe that the latter described conditions have largely been a product of the former, that is, that we have in the United States, a large number of people who are wedded to English ball clay. That fact, of course, becomes known to the producer of English ball clay, and as the difficulties of mining have become greater to him, labor conditions have become more unsatisfactory, and he has been crowded for shipments, he has undoubtedly sent material over which he would not have shipped if he had thought he could not get his money for it.

It seems to me that the solution of this situation is about as follows: We have in the United States a great variety of ball clays, perhaps not one of which we can substitute for any single English ball clay. We know there is light-colored English ball clay, which is peculiarly adapted to certain work, and dark English ball clay which is considered more desirable for other work, and we know that many of our American manufacturers use a certain combination of two English ball clays.

I believe that we should find out whether we can obtain a combination of American ball clays which will closely approximate the English ball clays or the combination of the English ball clays.

I am convinced that a course of that kind would result satisfactorily. I do not mean to say that you can make a body which you can give to your potter and that he cannot tell from the body which contains the English ball clay. Perhaps he can. Perhaps it would require some change of mental attitude in order to convince him that he could work the body with the American ball clay in it just as successfully as he works the body with the English ball clay in it.

That is a matter that will have to be worked out in the factory.

The problem is one of finding out what the essential physical characteristics are of the American ball clay and of the English ball clay, and ascertaining whether by a combination of the American ball clays which we have, it is not possible to produce something which would be a substitute for the English ball clay. And I am convinced it can be done. It may mean that our ball clay producers will have to determine the physical properties of their ball clays or have them determined and be prepared to show by what combinations they can be substituted. It may mean that the potters will have to agree to have the bodies containing American ball clay tested out in their factories in order actually to establish the feasibility of the substitution.

There is one point that deserves a little special emphasis, and that is the fact that the impression prevails (and it may be correct) that the English ball clay, when incorporated into a body, encourages earlier vitrification than is the case when the American ball clay is used. Now whether an American ball clay exists which will provide this earlier vitrification, or whether this earlier vitrification can be provided successfully and satisfactorily in some other way, remains to be determined.

These are all subjects which will require a certain amount of careful investigation, but I believe that if England was dependent on the United States for feldspar, she would have sufficient consideration for the future of her industries so that she would very carefully determine whether she did not have a home product which could be successfully substituted. I believe that we, as Americans, should display the same attitude.

Mr. Crane: That is just along the line of my thought and seems to me an excellent idea. Instead of asking the producer of clay to bring something to your factory, you men who want to use clay tell the producer the material you want to use, and see if he is able to bring you the stock you want to purchase. Do not ask him to bring something to your factory which you use any way you please, or in any way that you think best. If the product is not what you want, do not blame the poor miner. He is not technical.

MR. BELL: A question has been asked as to whether the bonding strength of the clay governs its price. Speaking for ourselves only, I will say that it does not. The reason our strongest clay costs the most is because it is overlaid by a bed of lignite and as a consequence costs more to produce. This lignite permeates the clay in places and must as far as is practical be trimmed out by hand. The stronger clays almost invariably have this lignite over them.

Prof. Watts spoke about giving data on clay to help the user. We have a chart about a yard long giving as full data as we have been able to get, on all of our clays. The government has issued a bulletin on English ball clays and a number of domestic clays.[1] Thus the user can procure data on all of the imported and domestic clays for comparative purposes. I suppose Prof. Watts has in mind the use of domestic clay everywhere, exclusively. We get into every line in which ball clays are used and, in a number of places they are used exclusively, which seems to indicate that the manufacturer could get along without the imported ball clay. However, there are many users who do not feel this way about it and thus it is likely that imported ball clays will always be used, but as stated, the data is pretty well worked out for those who wish to try the substitution of the domestic for the imported clay.

Where one manufacturer uses the domestic ball clay and another making the same line does not or cannot do so satisfactorily, it is probably due to some factory condition and therefore comparative data on the imported and domestic clays will not be very helpful. We are always glad to furnish our chart to anyone who is interested and to supply samples of any clay they may select. No doubt the Government Printing Office is in a position to furnish such bulletins as they have prepared on the matter.

SECRETARY TREISCHEL: The question Dr. Langenbeck has brought up for discussion is one in which he asks the question, "What has been the experience in substituting domestic secondary and primary kaolins for English china clays?" and he includes domestic ball clays for English ball clays.

The Company with which I am associated manufactures electrical porcelain by the dry process, the wet process and the cast process. In the six years I have been associated with that Company we have used seven domestic ball clays, and three English ball clays, three English china clays, and one domestic secondary kaolin. We have also used a small amount of one domestic primary kaolin, which petered out and we were not able to get a supply of it.

We have worked out bodies in which we can interchange these materials to suit our will so that at the present time, we are practically governed by f.o.b. our works.

[1] A. V. Bleininger and H. G. Schurecht, "Properties of Some European Plastic Fire Clays," Bur. Stand., *Tech. Paper* 79 (1916).

MR. McAFEE: I think one consideration of this domestic clay is the reliability of supply. None of us like to change our formulas after we get one that works.

We have had quite a bit of difficulty in the past in getting the same domestic clay, and we seem to be able to get the same English clay with greater ease than the domestic clay. That may be because there is a larger reservoir between the mines and the consumer.

The question of substitution brings out again the necessity of more accurate laboratory control. Dr. Langenbeck has mentioned the possibility of combining primary and secondary kaolins, and Prof. Watts spoke of a definite procedure along this line. If we knew more about what we wanted, in a technical way, and when we had it, the problem would be much simplified.

MR. HUNT: In our experience we have found that the shipments of American china clay vary greatly from shipment to shipment, and that is not so true of the English china clay; it is more uniform. As to ball clays, a number of American ball clays have large deposits which can be used with success because of their uniformity, which is the great consideration.

If you can adapt your works for a certain clay and the clay changes, you are "out of luck."

When the American china clay is produced in a uniform quality you will find it a more likely substitute for the English china clay.

MR. CRANE: Mr. Hunt says you buy clay, getting it in regularly and if it changes, you are "out of luck." I think he should know what he wants, and when the material comes in he should examine it to see that it is the kind of material he wants to use in his mix. When he has determined that matter, he can use the kind of stuff he wants to use, and he will turn out a uniform quality of goods.

MR. HUNT: We do know what we want. We want uniformity.

MR. BRIAN: I do not know of any importer of this commodity, my company included, that can guarantee any pottery manufacturer in America an absolutely uniform English ball clay. In fact, my company positively refused to make any such guarantee.

We have been in the importing business for the past thirty-two years and the experience has been that English ball clays will vary from shipment to shipment. What I mean by variation in clay is that sometimes the clay will be of a lighter color, other times darker.

English ball clays when mined run various colors, some blacker than others. Our experience has been that ball clay mined by the shaft operation ordinarily is better than open mine working.

I have just had seven analyses made by Dr. Wolfe of the Imperial College of Science and Technology, South Kensington, London. These

analyses covered the light clays, medium dark clays, and the very dark clays. All the samples submitted were from different operations, although the analyses are all about alike. The question is then, what do the analyses amount to except to tell us of the different ingredients therein.

Mr. Gesner and other importers were in this meeting and possibly they can guarantee a uniform ball clay, but I am satisfied that consumers of our ball clay in this meeting can frankly tell you that while we ship them a good grade of ball clay it is not a uniform material. They are satisfied that they are getting the best that can be gotten out of the mines, and I think Mr. Bell will advise you that they are having about the same trouble with ball clays in America. This is referring to the uniformity of ball clays.

Mr. Bell: We mine our clays each strata separately. In addition all impurities are trimmed out as nearly as is practical. This is as close as we can come to producing our materials uniformly.

Mr. Brian: I have asked our producers in England, at an increased price, to separate as nearly as possible the black clay from the light colored clay, and this they are doing. The consumer is compelled to pay the increased cost for the black clay, and the same price for the mixed clay as mined, and the same price for the light clay as for the mixed clay. This is, of course, the light clay selected from the black clay. I likewise ask that the consumers take in a certain amount of the light clay, as the producer in England insists upon my company taking both the light and the dark clay. By this separation this company has as near a uniform article as is possible. This selection enables the manufacturer in America to better gage his mixings insofar as English ball clay is concerned.

Mr. Gesner: We do not guarantee a uniform English ball clay. We cannot maintain it. They take it as it is. With the development of technical science there has been a corresponding increase in the demand for English ball and china clays. That is good enough for me. If you, who have technical knowledge with your combined intelligence, can work out a process of teaching the clay miner to develop what you need and improve these domestic clays, perhaps that would solve the problem. We hope you will not succeed in doing so. We do not gloat in your misfortune, but we take it for granted you buy our clays because you need them, and we are very much obliged for your patronage.

Mr. Fritz: The statement that Mr. Brian made that English ball clays are not absolutely uniform, I think can also be made relative to American ball clays, only to a greater degree. Prof. Watts' statement is true, that American clays will not vitrify at as low a temperature as English ball clays, and also do not have quite the bonding strength.

I have examined a great many American ball clays, and I can count on my hand those which will even approach the English ball clays in vitrifica-

tion temperature and bonding strength. None of them equal the English ball clays in vitrification, but I have found two that do equal in bonding strength. These two clays are vitreous at cone 10 but the vitrification does not begin at as early a temperature as the best English ball clays. This fact together with the greater non-uniformity of the American clays makes the use of these clays not as safe as the English. It simply means that you do not have the safety factor with the American ball clays that you do with the English clays. The latter will vary a little, but you still have vitrified ball clay at cone 10 and you will also have a more uniform bonding strength over a period of time. This, we feel, is important in our wet process electrical porcelain work.

If we could get these American ball clays more uniform, so that they would be closer to their best, at all times, then we could use them without any trouble. We have been able to produce porcelain with these two particular kinds of ball clays, which have the properties that are practically equal to the English ball clays, and the porcelain as far as we can test it is just as good as what we have made with the English clays.

It may be that adjustments can be made so that these natural variations will not affect us, and it is toward that end that we are working.

I hope we can work it because I would like to see our country use its own products.

If you do not need a low vitrification temperature or very high bonding strength, there is no trouble in using the American ball clays, for there are many that will adapt themselves under such conditions. In manufacturing dry press electrical porcelain, we can use ball clays of that type, and we therefore use several American ball clays without any trouble. The only governing factor is price, just as Mr. Treischel explained.

That is all that I can offer at the present time. We are working on it and I hope I can present something more definite by next year.

Mr. Gates: In our terra cotta business, we do not wait for the architect to come and tell us what kind of terra cotta he wants. We have to show him what we can make and if that is not right for his use, we have to make it right for his use.

I feel that the clay industry of this country is dependent largely on the energetic action of the men who are digging the clay and marketing the clay and hunting out the requirements and needs of the different potters, and adjusting their clay if it needs adjustment, handpicking it if it needs handpicking or washing it if it needs washing, and getting it so that they can come to you and back up their material and say, above all things, that every carload you order will be identical with the last carload shipped. If we can get our clay industries in that condition in this country, we will not have to go abroad for clay.

Dr. Langenbeck: I think we should insist that the technical men give

information in the way of tangible standards that can be put down into direct description of physical properties, accompanied by figures.

This is, of course, a fickle product, an elusive one, and even Prof. Watts is not prepared to say that we can define in this way as yet in a positive manner. But we certainly have to make progress in that direction, and it is up to the clay producers, if we give them a hand in that direction, and it is more up to the clay consumers to give them a hand.

The clay consumers have reached a point where they have technical men and are employing them now. The necessity of that has not been made obvious to the producers.

As soon as you technical men make an approach, no matter how small, in that direction, of giving facts that are tangible in temperatures and percentages of these subtle properties of clays that are not shown in the ordinary mineral analysis, the two groups will approach each other. That was partly my hope in starting the original trouble of putting chemistry in the clay industry, although it has made a profession for a good many of you.

I hope that you technical men here will rise to the occasion better than you have done so far, and say, if you reject the clay from your works because it was not uniform with the last shipments, "What tests did you make? What tangible figures have you tried to get, so that if it were a matter of law you could show, and not a matter of opinion?"

Now what tests have you made privately, to satisfy your own scientific conscience, to approach a little in the direction of this tangled solution that Prof. Watts has spoken about? Some of you may have made other tests, maybe only qualitatively, but the straws show in which way the wind blows in finding our way through the maze of this elusive plasticity and its coördination with a wide vitrification range that will make your body immune to these different temperatures so that you will still get a good electrically resisting porcelain.

Will some of you give some of your private experiences or some theories that you are working on in order to approach this subject? You may not have been able to carry it out as you thought you could, but somebody, if you mention it, may recall something they have done in that line. That is how we get our ideas from the articles that appear in the journals. We read the *Journal* diligently, not to find the man who has solved the problem, but who has met a difficulty similar to our own and probably failed. So you say, "Well, that part is done. I do not have to repeat that. I am going to attack it from this angle."

Professor Watts: The question of color has been raised once or twice, and I am increasingly impressed with the fact that in many lines of whiteware manufacture, there is a feeling that the American market is favoring some other color than dead white.

I was talking with an importer. He was telling me that there seemed to be a decreasing demand for the dead white porcelain of Continental Europe. If that is true, it means something. It means that there is a possibility that the extreme whiteness, which at one time we demanded in our china clays, may not be as vital as it was.

Perhaps it would be worth while for the American manufacturer to consider whether, collectively, the color of the whiteware could not be changed to a very pale ivory. We know that the wonderful beauty of the Lenox ware depends not on its perfect whiteness but on its other properties, and while they are difficult to define, nevertheless its excellence is recognized.

I believe that the color problem is not as big a problem as it was a few years ago.

I do not believe it is going to be possible for a good many years for any manufacturer to say to the man who supplies his clay, "I want a clay with a plasticity value of Pi-4-B." I do not believe he is going to be able to supply that if it is called for. He might have to offer a clay with values "Pi-5-B" or "Pi-5-A."

I do not think there is a manufacturer here but would have a headache if he would try to state how many clays he has tested out in his factory to see if they met his requirements. All of the manufacturers are testing them all of the time, and while they may not be able to express exactly the combination of properties that they want, in numerals or percentages or any other values, they test them all and they find the one which most nearly approaches the one they desire.

Now, as I brought out in my paper,[1] I believe in specifications of ball clay. There is a grave mistake being made by the testing of clays, or any other ceramic material by themselves. I have harped on that until I guess I am pretty well recognized as an advocate of only testing the material in the body in which it is to be used.

A great deal cannot be told by firing a material by itself. It must be incorporated in a body in which you are going to use it. Especially in whiteware bodies. There should be no hesitancy on the part of the manufacturers in testing a ball clay in a body of stated composition. The one I recommended was 20 of standard feldspar, 30 of standard flint, and 50 of standard clay. You can make it 30 of china clay and 20 of ball clay substituting for the other, the material which you are testing. You can say to the man from whom you are buying any of your materials, "The sample marked 1 is the way I want it. Your material is substituted in the sample marked 2. This body cracks or this body warps, or this body does not vitrify, and this body is bad color."

[1] *Bull. Amer. Ceram. Soc.*, **3** [8], 288 (1924).

There are a dozen things we can say about it after we have made the test, but the man who ships the clay must not say to us, "Well, tell me how to fix my clay." He must remember, of course, that if his clay will not do, if I am not satisfied with the clay he is shipping me, he must offer something else, and if he does not offer something else, I am certainly going to buy the best I can get from somebody else.

DR. LANGENBECK: I think this is excellent ground and also that further work in analytical determinations will also lead to the use of symbols that will mean something definite.

You have heard from Mr. Bell, I think, that the strongest and best clay he makes, he gets the highest price for, and he is modest in saying that he asks the highest price only because it costs him more to mine it.

I want to coördinate, and I want to get you into the habit of coördinating these chance remarks, and see what they mean, chemically, with what was said by Mr. Brian. I believe in his endeavor to get the English manufacturers to separate the light clay from the black clay.

I was the first ceramist to develop the American ball clays. Samples of my original ware can be seen if you happen to be in Kentucky at the State House at Frankfort, in the museum there. That was the first American ball clay gotten out. I got it out and shipped it to Cincinnati to the Avon Pottery. When I was with the American Encaustic Tiling Co., and other companies a number of years afterwards, I also introduced its use in a definite mixture of light and dark lump, just exactly as Mr. Brian has described the English clay.

I separated that, myself, for particular uses, and I found, as Mr. Brian has described, that the stronger clay and the clay with the longer vitrification range, was the black clay.

I coördinate that with what Mr. Bell said. What is that black stuff that is in the clay? You may put down in a vague way, "Organic matter and loss" in your analysis. But it is vital to know what that is.

That black matter to some degree probably infiltrates from the lignite Mr. Bell has spoken of into his strongest clay. In other words, it is what the dirt farmer calls "humus."

The trouble with our CERAMIC SOCIETY (if you will pardon me for criticizing you) is that you sit in a water-tight compartment—you are not taking enough notice of other people who are also dirt farmers and working with clay for their own particular purposes.

Now in order to get one of these factors represented by a symbol or whatever you want, or at least another item in your analysis of a clay that is not a mineral, supposing you do what the agricultural or soil chemists are doing, determining the humus in the clay, and then see if the proportion of the humus is not a factor and an important factor in this matter of plasticity, and possibly also further in this range of vitrification.

Now let me suggest to you who are earnestly engaged in the analysis of clay to add humus. In Wiley's book on "Soil Analysis and Agricultural Analysis," you can find methods of doing it. It is perfectly simple.

This will give you one more item in your analysis of the clay, and maybe it will run to something of value.

MR. TWELLS:[1] Through reading over the discussion on this subject I have received the following impressions as being the composite opinion of the various speakers. English ball clays compared with American ball clays: (*a*) are more uniform; (*b*) give a better color to a body; (*c*) vitrify at a lower temperature; (*d*) have a better bonding strength in the unfired state, and (*e*) give better plasticity or working qualities to a body. On the other hand there seems to be a general complaint that the English clay miner is not playing fair, *i. e.*, that he takes an advantage because he believes that we have to have his product; he makes us take the grade of clay which suits him best, he soaks the clay to the maximum with water, and then charges his own price. For this reason there has been for several years an earnest desire on the part of many to utilize American ball clays in our whiteware bodies. My own personal sentiments favor this course and I wish to point out some ways by which I believe it can be done successfully.

In regard to uniformity, the importers of English ball clay, who have spoken, agree that it is not uniform and that they cannot guarantee its uniformity. Moreover, as Professor Watts has pointed out, it is undoubtedly true that some of the English ball clays are dirty and unreliable. At the same time we must also admit that American clays are not strictly uniform—each car the same. This brings me down to the point I want to make. That all clays whether English or American are not uniform as they are received at the pottery. But they can be made so with relatively little cost by observing simple rules in unloading, storing, and withdrawing the materials at the plant. It is not a difficult job and the remedy gives positive results. This phase of the subject I have already discussed in a paper given before the Whiteware Division at this convention.[2] Again, how many plants make a practice of making up a trial run of body out of each new bin of clay, in order to get a sample lot of that ware out of the kiln before the bin has to be used? Relatively few plants go to that trouble and yet it might often save a lot of money regardless of what kind of material was in the bin. If the advance test indicates that a material is different from that in previous bins, might it not be possible to make a small correction which would right the difficulty before a large amount of ware is made and spoiled? It is no doubt true that there is plenty of room

[1] Received April 10, 1924.

[2] "Handling and Storing Raw Materials to Produce Uniformity in a Body," *Jour. Amer. Ceram. Soc.*, 7 [2], 82 (1924).

for improvement in the methods used by the American clay miners; yet I believe that if those who complain about the lack of uniformity in American clays will check up, they will find their chief trouble lying in their own plant processes.

That English ball clays vitrify at a lower temperature I admit, but I feel sure that the composition of the body could be altered slightly to make up for the differences in the American clays. I agree with Professor Watts that a clay should be tested in a body as well as alone. But I disagree with his suggestion of testing it only in one standard body or in whatever body happens to be in use at a plant when the sample or car of clay arrives. I do not think it fair to condemn a clay solely because it might fail to give good results in one particular composition. I know from experience how common a practice it is in a plant to attempt to substitute one clay for another without scientifically correcting the body to compensate for the change. For example a plant runs out of English ball clay; some one failed to order it in time or the car was delayed; there is a bin of Tennessee ball clay at hand. The slip room foreman or the superintendent has the one substituted for the other and we all know the result. There is trouble all through the plant. Everyone forever after condemns Tennessee ball clay and says that only English ball clay can be used. It would seem fair to condemn a clay only after it had been tested in a considerable field covering a wide range of different compositions. The trouble usually lies in the fact that we do not, as a rule, work the problem out carefully in the laboratory, or if we do work it out carefully in the laboratory, we let it rest there and do not apply the results scientifically on a large scale in the plant.

Regarding the color produced in a body by American ball clays, as compared to that by English ball clays, I agree that taken as a whole the English ball clays give the better color. But I have tested a considerable number of English and American ball clays in whiteware bodies in direct comparison and I have found that some brands of American ball clays give as good a color as the best grades of English ball clay and even a better color than other grades also sold as first quality. Of course some brands of American ball clay do give a body a distinctly creamy-white color but this, as pointed out by Professor Watts, may be less of an objection in the future than at present.

I also agree that English ball clays give better plasticity and better bonding strength to a body. Professor Watts mentions that some manufacturers have overcome this defect in American ball clays by using slightly more of the clay. He also suggests that a combination of ball clays may serve the purpose. I would also suggest that a very small percentage of bentonite be tried along with the American ball clays to help develop the plasticity. Professor Cox has shown us at this con-

vention that with a small percentage of bentonite he can make a North Carolina kaolin as plastic as a Kentucky ball clay.[1] This would seem to indicate that with bentonite we could develop any degree of plasticity required.

Personally I agree with several speakers that American ball clays can be used. I feel sure of this because many plants have used them successfully for years. The fault as I see it lies chiefly with the ultra-conservativeness of our craft. Several speakers have already referred to this. We dislike to adopt new methods and use new materials. I cannot agree with the policy that the only change warranted in a body is one which will result in an improvement in quality of the finished ware. I, too, feel that we should not lower our quality, but if we can produce a quality equally as good using cheaper materials and materials of American origin, we are justified in doing so.

DISCUSSION[2] ON "EFFECT OF MUFFLE ATMOSPHERE ON FIRING ENAMELS"[3]

MR. VOLLRATH: What type of furnace was used in the large scale calculations?

MR. COOKE: That was the muffle furnace.

MR. SCHWIER: Do the firing racks used in support of the furnace have to be taken into consideration besides the amount of ware being fired in any furnace?

MR. COOKE: There is no question but what this is true. The oxygen will be absorbed more or less by the firing racks, depending on the sort of equipment used. But as far as I have gone, it is very problematical whether there is any calculation referring to any large full-sized furnaces which is at all accurate. Whether or not any inaccuracy comes in by not taking into account the firing racks, it would not be considerable.

MR. HANSEN: Mr. Cooke has shown very clearly that a certain amount of iron oxide on the sheet is necessary to get the enamel to work properly. I just wondered whether the introduction of iron oxide in the ground coat, just as we have our cobalt and manganese, would give the same effect. I have seen a combination of iron oxide and cobalt used, and I wondered whether oxygen was necessary in that case.

MR. COOKE: I have not tried that just as you have put it. But taking into account the quantity of iron oxide formed as a film in proportion to the weight of the enamel the percentage was rather high. And I doubt if

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[1] Paul E. Cox, "A Study of Plasticity by Practical Potters' Methods," *Jour. Amer. Ceram. Soc.*, 7 [3], 5 (1924).

[2] Presented at Atlantic City Meeting, Feb., 1924 (Enamel Division).

[3] R. D. Cooke, *Jour. Amer. Ceram. Soc.*, 7 [4], 277–81 (1924).

the same effect could be gained by adding that much raw oxide to the enamel without disrupting the formula.

Mr. Vollrath: Was the material used in those grates cast iron?

Mr. Cooke: Our regular equipment was not used in the experiments. The calculation for standard ware in the standard furnace is purely a mathematical problem. No experimental work was done in our furnaces.

Mr. Landrum: As I understand it, from your calculations there will always be plenty of air. Am I right?

Mr. Cooke: No, not necessarily. Experimentally I found that six cubic inches of air to one square inch of enamel surface was about as low as you could go in air capacity. And by making a few calculations I found that that limit was often dangerously approached in practice.

Mr. Landrum: We find these data very interesting. Blistering occurs while the ware is cooling. If enlarging the furnace or introducing air will assist, we have here a real practical suggestion.

These data will be especially interesting to those who are considering the feasibility of a continuous furnace, of a furnace that will have just as little air space in it as possible in order to conserve heat. It looks as though air will have to be introduced along with the ware; *i. e.*, have a circulation of air.

Mr. Sweely: Mr. Cooke, did you find any detrimental effects from having too much air?

Mr. Cooke: No.

Mr. Poste: Some work that we did some time ago might be of interest here. Our problem was to substitute oil for natural gas as the fuel in a direct-fire enamel furnace. In the first place we asked ourselves the question what are the essential conditions by way of atmosphere in a direct-fire furnace? Having answered this we next reproduced the conditions in the oil-fired furnace.

Our findings apply to our particular furnace and enamel. Probably the quantitative conclusions would not apply exactly under different furnace and enamel conditions. The general principle should hold, however.

We found that with from three to four per cent free oxygen in the gases in contact with the enamel we encountered traces of the trouble that Mr. Cooke has in mind. With the oxygen down to 2% serious trouble resulted. With oxygen at 5% we had no trouble. We concluded that 7% could be taken as a safe working requirement.

We then worked out a system of controlling our oil burners so that we realized about 7% oxygen in the furnace atmosphere and no trouble comes as long as these conditions are maintained.

Mr. Cooke: I might mention another source of error in firing hollow ware. We have more air really than the actual capacity of the muffle

would indicate, because as hollow ware goes into the furnace it carries with it cold air in the interior. When it becomes heated it expands to some 2 or 3 times its original volume, which gives considerable excess air. That would not apply to flat ware.

Another thing: We one time experimented with a semi-muffle furnace, gas-fired, and found that we always got this ruffling or fine blistering with ground-coat enamel but were very successful in burning cover-coat enamel.

Mr. Lindemann: I should like to ask Mr. Poste whether he had that same effect with cast iron as with steel.

Mr. Poste: We have never worked with cast iron at all in a direct-fired furnace. That was sheet steel altogether. I wonder if there are any observations relative to cast iron.

Mr. Bardush: Mr. Cooke referred to the ground-coat blistering. I had that about five years ago and plenty of it with producer gas. The only way I could overcome it, was to fire the ground coat about half, take it out, chill it and put it back again. By this means I got rid of it.

That was too much work. I commenced to treat my coal before firing into the gas producer. Instead of yellowish gas, I obtained a bluish gas. I had no more boiling or blistering.

You have the very same thing with a direct-fired furnace with a poor grade of coal. I had it not long ago.

Chairman Staley: With what did you treat the coal?

Mr. Bardush: With calcium chloride, twenty dollars a ton.

Mr. Jaeger: Mr. Landrum has drawn attention to the danger of building too low a furnace or a furnace of very shallow depth from the bottom to the top of the muffle. About six months ago, we started to operate a furnace the spring of the arch of which is about eighteen inches from the bottom. We have benches that support the ware racks which are about eight inches high. If there was a danger of not getting enough fresh air we are about as close to the limit as we can get. After an operation of six months we think we are getting very good results. We have not observed anything that would raise a suspicion of insufficient air. And we have been firing flat-ware enamel during these six months.

Mr. Manson: I was interested in what Mr. Hansen asked about adding iron oxide as such to the enamel itself, because it is a rather common practice among sanitary ware men to add a little iron oxide to the ground coat. They think that it makes it easier for the coater to see whether he has his casting covered. But I have always wondered whether they might get some beneficial effect from it which they did not know anything about. I am trying to find that out myself.

Mr. Vollrath: What was the over-all height of that muffle, Mr. Jaeger?

Mr. Jaeger: I think it is eighteen inches and I think the arch is about seven inches from the spring in the center.

CHAIRMAN STALEY: Mr. Cooke, there is one question. Would you say you get blisters when you do not have iron oxide present?

MR. COOKE: No.

CHAIRMAN STALEY: Well, what makes the blisters?

MR. COOKE: I should like to ask that myself.

CHAIRMAN STALEY: I could understand how iron oxide could make blisters by giving up oxygen, but I do not understand how lack of iron oxide could make blisters.

MR. COOKE: I tried to determine that in the analyses of exhaust gases from the furnace. I was looking for some foreign gases that were not in the air that went in, but I did not find any. If this blistering was caused by the evolution of a gas either from the surface of the steel or from the enamel, it did not escape into the surrounding air in any sufficient quantity to be detected by analysis.

MR. LANDRUM: Practically all formulas for ground coat either contain nitrate of soda, nitrate of potash or manganese dioxide. I suppose you have tried these one by one.

When all of the oxidizing agents are left out of a ground coat I find it is inclined to blister. Although a ground coat can be made without oxidizing agents in it, still a more fool-proof enamel is made with oxidizing agents. Therefore, in most of these enamels we still find these nitrates. Although these are put in at the smelter rather than at the mill their oxidizing effect is still there.

MR. POSTE: On that point, I have tried experimentally to leave out the nitrates in a ground coat having nitrates in the formula. As a result metallic cobalt, actually identified chemically, plated out on the steel stirring rod used in stirring the smelt in the crucible.

MR. LANDRUM: And when you used nitrates it did not happen?

MR. POSTE: No.

MR. COOKE: Of course, we know of the oxidizing power of the nitrates and probably most of the manganese dioxide is exhausted in the melting. I did not bring any figures as to the oxide formed on the steel under the enamel, but roughly I made some calculations to see if some oxidizing agents could not be added in the mill during grinding. I found that to get the oxygen which is equivalent to the weight to iron oxide formed, it would be necessary to add something like thirty per cent of manganese oxide.

CHAIRMAN STALEY: Mr. Cooke brought out the important thing about the iron oxide film. It is a physical rather than a chemical effect. The fact is that when the steel is covered with a thin layer of iron oxide the enamel wets the iron oxide, spreads out and attaches itself to the steel. When it is not covered with the iron oxide, it draws up into beads. The iron oxide acts not only chemically, but also physically. If you have the

same amount of oxide present mixed with the enamel it would not stop the beading and pulling up of the enamel.

MR. SWEELY: It is rather interesting to note that if the metallic oxides are omitted from the average ground coat and applied to a piece of steel, the fire required to make a smooth coat is very much decreased. I was wondering whether Mr. Cooke had experimented with anything along that lime—omitting the cobalt and metallic oxides.

MR. COOKE: No, I have not.

MR. SWEELY: I found with a glass that requires three minutes to mature on a sheet of 20-gage steel, the glass free from cobalt can be fired in about half this time without blistering or pin holes or anything of the sort appearing. If there is a reaction between the cobalt and the steel this is a possible explanation of the reoxidation of the steel. That is just a suggestion.

MR. SCHWIER: On your ordinary equipment you will find you cannot go under Mr. Cooke's estimate of six cubic inches for one square inch of surface. We have an electric furnace which is twelve inches to the spring line of the arch and seventeen inches to the top of the arch. By taking the volume on the basis of twelve inches high all the way across, we still have about two hundred and thirty cubic inches per square inch of enamel surface. So you cannot have the hole in the furnace much smaller than that and still get your fork in, raise it and bring it out again. That is about as small a muffle as you can get. The ware would have to be laid on the flat rack much lower than the present firing points to bring it anywhere near the figure Mr. Cooke mentioned.

MR. KORMAN: With regard to iron oxide, I had what I thought was iron oxide on a casting both on the ground and the enamel. The enamel seemed to draw away from the iron spot.

MR. LANDRUM: If the black shape is not cleaned before putting into the furnace, the enamel will crawl; however, I believe Mr. Cooke has a patented process of oxidizing the sheet and does not have to pickle it. Am I right, Mr. Cooke?

MR. COOKE: Yes. It is the same story. You supply the oxide film before you enamel it. And you and I know that the oxide film is absolutely essential. So if there is nothing but oxide on the steel to start with, why should it be removed and then put back on again?

MR. MANSON: In line with what Mr. Korman stated, it is possible to enamel cast iron with a dry process without a ground coat and get a perfectly smooth piece free from blisters. But when I say without a ground coat, I mean that I did have a ground coat of iron oxide on a piece. I have made many pieces in the laboratory.

I have never been able to enamel a piece of cast iron without a ground coat when the iron was cleaned. When I took a piece of cleaned iron, wet

it and let it stand until I got an even coat of rust on it, I had no trouble enameling it without blisters.

CHAIRMAN STALEY: That is, with comparatively high temperature?

MR. MANSON: About 1650°.

CHAIRMAN STALEY: It is well known that cast iron can be enameled by the wet process without a ground coat if you keep your temperature down quite low, that is, below 1250°.

MR. MANSON: That is not only done in the laboratory. I have enameled closet tanks in the factory by the same method. Of course, it is much more simple to use a ground coat. And I do not think a little iron oxide on a casting would have the result Mr. Korman described.

MR. KORMAN: It may be possible that these two men have different processes whereby they are able to do that and get away with it. I do not see why one should disclaim the possibility of a perfect enamel when the whole casting has a film of oxide simply because iron spots cause crawling.

MR. MANSON: Spots of iron oxide might not be very thin whereas a film of iron oxide closely held to the iron is thin.

MR. COOKE: We should not let any confusion remain as to exactly what we mean by iron oxide in this discussion. What I have been talking about all the time is heat oxide or the blue surface we get from heating metal in the air. There appears to be some idea that I might have referred to a coating of rust. I know nothing about the effect of rust.

MR. ANDERSON: We do exactly what Mr. Cooke here claims, every day in the year. We are making hundreds of pieces without pickling. We put this film of oxide on the article by heating and it enamels just as well as with pickling.

CHAIRMAN STALEY: Do you mind explaining just how you do it?

MR. ANDERSON: We do it the same as if we were scaling it. We do not use much heat but just barely enough to blue it. We then dip it into the ground coat and fire it.

MR. COOKE: Is that cast iron?

MR. ANDERSON: Steel, not cast iron.

MR. SCHWIER: May I ask how you get the shop oil off from the piece?

MR ANDERSON: We put the piece into the furnace and then remove the scale. This gives a film of oxide. Then we dip it and fire it in the regular form.

CHAIRMAN STALEY: You do not clean it after scaling? You simply scale the piece in the ordinary manner? What if it has a rather thick film of oxide?

MR. ANDERSON: We do not allow that. The material that comes to us is what they call common rolled stock. It is not regular enameling stock. It is not very good stock either.

REFRACTORIES QUESTION BOX

E. E. AYARS, EDITOR

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire-clay brick to spalling?

2. What difference is there between the properties of a soft mud machine-made and a hand-made brick?

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in firing of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand-made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure at a lower temperature of fire brick subjected to reducing atmosphere than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

10. At what temperature does fire clay break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_3 \cdot 2SiO_2$?

11. What properties should a clay brick possess to give good service in rotary cement kilns?

12. What properties should a clay brick possess to give good service in vertical shaft lime kilns?

13. How can the water content for wet pan charges be gaged?

14. What simple laboratory tests can be used to keep the quality of refractories up to standard?

15. What is the cause of the swelling of fire brick in the hearth and crucible of a lead blast furnace after the furnace has been blown out and is allowed to stand idle?

16. Will a high alumina brick resist metal absorption in a lead furnace? If so, what is the minimum alumina content required in such a brick?

17. What is the best type of refractory for lead blast furnace work?

The effect of coal ash on refractories. J. J. BRENNAN. *Combustion*, **10**, 418–22 (1924).—The metallurgical point of view is adopted wherein the ash from the coal and the furnace lining are compared to a smelter charge and lining. Chemical analyses are given of 9 coals and their ashes and of 14 bricks, Fe-free. Mixtures of 70% ground fire brick and 30% coal ash were prepared, each brick in combination with each ash, and molded into triangular cones, inclined at a 45° angle with the horizontal. These were mounted on slabs of highly refractory material. Similar cones were prepared from each ash and from each brick alone. These were heated in a gas-fired furnace in a reducing atmosphere; four hours were required to reach the maximum of 3000°F. The condition of the cones was observed at 20° intervals. The temperature of the initial deformation of the cones, *i. e.*, when the tip assumed a horizontal position, was noted and

the results were plotted. In the majority of cases, actual life of furnace linings follows closely the indications given by the charts. J. F. B. (*C. A.*)

Discussion

This is an excellent paper and shows the result of a great deal of painstaking work. It is regrettable that Mr. Brennan was unable to include the analysis of all the brick tested. An interesting point is that the relation between the composition of the coal ash and its destructive properties is not at all definite. In a general way the total of the Fe_2O_3, TiO_2 and CaO is a measure of the activity of the slag. Between the composition of the brick and its resistance to the ash, there is even less agreement. When the alumina of the brick is plotted against the fusion point of the brick-ash mixtures there is no semblance of a curve. There is tendency for the fusion point of the mixture to rise with increased alumina content of the brick, but it is only a tendency. The following diagram shows the alumina content of the brick plotted against the fusion point of the mixture of brick and Kentucky coal ash. The other ashes were even more erratic.

It must be remembered, however, that slag action is the product of two factors, namely, chemical action and erosion. The test used by Mr. Brennan measures only the chemical reaction. It is probable that in many cases, low resistance to erosion would more than offset the advantages of good resistance to chemical action. There is reason to believe that resistance to slag action is affected by the texture of the brick as well as by the composition. The most rapid destruction is obtained when particles of the brick loosen and float off in the slag. These particles might have an excellent resistance to the fluxing action, but if the nature of the brick is such as to allow them to escape, it avails nothing.—Robert F. Ferguson, Garfield Fire Clay Co., Bolivar, Pa.

In the August number of the Question Box a statement of the service conditions of refractories in oil-fired boilers using topped Mexican oil for fuel was given. Mr. Ferguson, upon reading the Editor's remarks presented some information on the presence of large percentages of titania in fuel oil slags. This was published in the September number of this department. The work of Brennan, who studied the effects of coal ash on refractories as described above, was reviewed at the same time. It appears to the Editor that fuel oil residues and coal ash must bear a close resemblance. Brennan found high titania compounds in his studies of coal ash-brick mixtures, but he did not carry his work to its final conclusion. He merely wished to establish a relation between fusion points of brick-ash mixtures and service of brick in the boiler setting. Readers are requested to review the August and September numbers of this department and submit further discussion of the problem. The Editor has a copy of the Brennan paper which will be forwarded to anyone interested upon request.—Ed.

Correction.—In the September issue of the *Bulletin* on page 352, I note that you give the fusion point of tridymite as 1670°C, and of cristobalite as 1625°C with acknowledgments to Searle. It is my understanding that Searle did no original work in this connection, but that his figures were copied from the reports of others. In a

paper, "The Melting Points of Cristobalite and Tridymite," by Ferguson and Merwin,[1] you will find a review of the work which has been done on this subject and a description of the work done by the authors. These figures are undoubtedly the most accurate of any available. They determine the melting point of cristobalite as 1710°C ±10°, and of tridymite as 1670°C ± 10°.—J. S. McDowell, Harbison-Walker Refractories Company, Pittsburgh, Pa.

In the October issue of this department the question, "At what temperature does fire clay brick break down into sillimanite and quartz?" was presented together with short discussions.[2] The paper deals with calcined clays but gives definite temperatures at which sillimanite is first noted in flint fire clay and plastic fire clay, and temperatures at which the crystals are fully formed. The quartz particles disappear with increase in temperature.—Ed.

Question

What is the best type of fire-clay refractory for rotary cement kiln service?

Discussion

Service in the hot zone of a rotary cement kiln is severe and each installation is a distinct problem in itself. Liners used should have a high melting point, a low coefficient of expansion, be resistant to abrasion at high temperatures and resist the attack of hot clinker. A brick which will carry a coating of clinker is desirable in most instances, although there should be no tendency to build up this coating to restrict the size of the kiln.

Certain cement plants have difficult raw mixtures to handle and the kiln liner must be of a very much higher quality than is required in some other plants. Burning temperatures are higher and the service on refractories much more severe in these cases.

There is practically no problem connected with the cold end of a cement kiln, except that a brick suitable for dry feed will sometimes not give satisfaction with slurry feed, but a medium grade of brick can be found which will serve in one case or the other. In the central portion of the kiln, the preheating zone, a good grade of fire brick is easily found to meet the conditions.

A southwestern cement plant has used three different kinds of hot zone liner. Two of these with fair success, the third with exceptional results. Analyses of the three brick are given in the accompanying table.

The far-western and the Missouri brick gave fairly good results as hot zone liners under rather adverse conditions of high temperatures and active ingredients of the cement mixture. This Company burns its clinker harder than the average and their products will stand outdoor storage for many months without deteriorating, which is an extraordinary thing in cement

[1] *Amer. Jour. Sci.*, **46**, 4th Series, 417 (1918).

[2] See H. M. Kraner, "Sillimanite Development in Some Typical Clays," *Jour. Amer. Ceram. Soc.*, **7** [10], 726–34 (1924).

	Far-western brick[1]	Missouri brick[1]	High alumina brick[2]
SiO_2	56.63	53.80	20.44
Al_2O_3	37.80	41.56	73.10
Fe_2O_3	1.07	2.16	2.09
CaO	2.90	1.12	.27
MgO	1.03	1.08	.13
Alk.	not det.	not det.	.79
Titania	not det.	not det.	3.63

(NOTE: Analysis of high alumina brick furnished by cement chemist showed about 10% of lime, which was checked and rechecked from original sample. New sample should have been taken from interior of brick. This brings up a point in shipping brick as well as one in analysis methods. Brick should never be shipped in a car contaminated with lime or other foreign materials. Brick loaded in the bottom of such a car naturally pick up more or less lime in the movement of the shipment and are liable to give a compromised service on account of the presence of such foreign materials in the surface of the brick. Samples for analysis should always be taken from the center of the brick. This point should be stressed by the manufacturer when he is discussing brick service with his customer.)

plant annals. These brick are both satisfactory for preheating zone and cold end of kiln, and one or the other is used when replacements are required. As hot zone liners they did not measure quite up to the requirements and the high alumina brick was installed for test. The first run of 5 months and 5 days showed a decided improvement in results and service over the liners previously used and the Company has adopted the high alumina liner as standard for the hot zone.

One of the striking things about the high alumina liner is the fact that in the 5 months' run a slight coating of clinker adhered to the brick, but on shutting off the kiln the coating was easily scraped off from the liners without apparent damage to them. There was absolutely no sign of fusion, no slagging, and no erosion worthy of notice. The only sign of trouble of any kind was a chipping of corners of the brick in a few courses due to unequal distribution of pressure. The kiln is of unique design and has improved the burning conditions very materially. It is larger in diameter in the hot zone than it is at the discharge end or throughout the preheating zone and cold end. As a result of this widening of the circle the brick have to be cut on the job to fit and the first installation was not as carefully cut as the second will be. The plant superintendent now understands the value of perfectly fitting circles and will see that the necessary time and expense is put on the next lining to insure the lining against failure due to chipping of corners. The kiln was taken off to replace old liners at the discharge end and to observe the condition of the high alumina lining.

It would appear from the service the high alumina liners are giving in

[1] Analyses by cement chemist.

[2] From *Brick Manufacturer*.

this instance that the ambition of the cement engineers may be reached in the near future: a cement kiln with an insulated lining. The shape of the hot zone of this particular kiln gives very much the same results that the insulated lining is expected to show. There are certain water-cooled rotary kilns in use in other countries which are intended to make possible a higher burning temperature, but this type of apparatus is difficult to handle and expensive to operate. The enlarged burning zone makes possible a higher burning temperature without imposing serious service on the high alumina liner and it is still the simple type of kiln.

One of the things noticed at this plant which is not considered good practice is the outdoor storage of refractories both for boilers and cement kilns. The action of frost is not feared to any extent although there have been occasional lapses from normal weather. There is a rainy season when it pours down in bucketsful and the brick are usually wet for long periods after this season. The storage piles were situated just under the kilns, which are out in the open, except for the feed and discharge ends. The heat from the kilns is said to keep the brick in fairly good condition. It was noted, however, that brick which had been in storage for considerable time showed distinct signs of deteriorating. The brick were weak and easily broken, where a new brick of the same manufacture stood rough handling. The superintendent of the plant reported no apparent reduction in service on account of the outdoor storage. In a section of the country where the extremes of temperature are encountered each year these brick could not possibly be stored out of doors.—ED.

"**Brick for Rotary Cement Kilns.**—While it might be supposed a basic brick would give the best results in cement kilns, according to W. Hamilton Patterson (British Iron and Steel Institute, Carnegie Scholarship Memoirs, Vol. 6, 1914) an exceedingly satisfactory brick was: SiO_2, 73.2%; Al_2O_3, 18.3%; Fe_2O_3, 6.5%; TiO_2, 0.4%; CaO, 0.4%; MgO, Tr.; alkalis, 0.50%; loss on ignition, 0.22%. The melting point was 1735°C. His explanation of the success of such a brick is that it fuses on the surface and forms with a cement clinker a protective coating. The question of protective coatings may thus be an important one in judging fire brick."—DONALD M. LIDDELL, "The Metallurgists' and Chemists' Handbook," McGraw-Hill Co., N. Y.

"The chief characteristics of Suprafrax as affecting rotary kiln operation are:

High refractoriness (fusion point about 3400°F)
Adaptability for taking and holding a clinker coating
Resistance to chemical action of the clinker
Resistance to abrasion
High load-carrying capacity under high temperatures."

Control of Size and Uniformity

"A further item of importance as affecting the lining service as developed in this particular type of lining as compared to the ordinary fire-clay type is the greater control of size and uniformity possible. Uniform liner dimensions facilitate not only the ease of the mason's work but promote better brickwork and thin joints, the latter being the highly desirable feature in the kiln construction. Due to its greater refractoriness, it is also feasible to use a 6-in. liner in place of the ordinary 9-in., thus requiring a smaller amount of power to actuate the kiln and in addition increasing the kiln capacity.

"The desired properties of this material as adapted to cement kiln practice are dependent not only upon raw materials used but also upon the methods of fabrication and manufacture employed. The grinding, molding and burning procedures used in the manufacture of refractories have a distinct bearing upon the properties of the finished product.

"More specific mention may be made of the properties of this high aluminous liner."

Fusion Point

"The fusion point is given as Seger cone 37–38 or 3400°F, Seger scale; 3308°F, Bureau of Standards scale. This fusion point is, of course, far in excess of temperatures reached in rotary cement kilns giving an ample factor of safety in the heating control as well as making it possible to go to high temperatures during the coating process."

Constancy of Volume at High Temperatures

"When subjected to the standard reheat test of the A.S.T.M. (C 27–30) calling for a continued temperature of 2552°F, for 5 hrs.—no change to slight expansion is shown. With such a property the lining will remain tight and rigid."

Resistance to Load

"A contraction of less than 2% is shown when the refractory is subjected to a load of 25 lbs. per sq. in. at a temperature of 2462°F, for $1^1/_2$ hrs. according to specifications C 16–20 of the A.S.T.M. This load carrying-capacity guards against any undue shrinkage in the lining which might be caused either by the weight of the clinker or the pressure caused by any expansion tendency of the material itself."

Resistance to Abrasion

"The material itself is exceptionally tough and strong and resists great abuse without showing any appreciable wear, it having a modulus of rup-

ture of from 800 to 1000 lbs. and an end cold-crushing strength of about 3100 lbs. It is highly desirable that a hot zone liner have strong resistance to abrasion under high temperatures.

"The porosity of this refractory lining ranges from 33 to 38%, in comparison to the porosity of 15 to 30% on ordinary fire-clay type of liners, yet it shows high mechanical strength. This is due to the fact that the relatively high porosity results from the physical makeup to the presence of a great many interstitial pores, all of which are relatively small; thus the individual pores which go to make up the total porosity are in themselves very small when compared to the pore spaces of many types of liners which possess a smaller total porosity. It is into these finely divided pores that the cement seeps during the coating process and lays the foundation for the much desired protective layer itself.

"In this connection there is another outstanding reason for success with Suprafax in the cement industry. When mixed with varying percentages of cement clinker and tested for fusion it is the least affected when compared with the more ordinary types of fire-brick liners. The action of the coating process is then that the lining, through its finely divided pore spaces, allows the clinker to take hold like so many 'fingers' and yet does not allow these fingers to eat it away rapidly through chemical action. Suprafax takes the coating and it holds it."—L. C. Hewitt, LaClede-Christy Clay Products Company, in *Cement, Mill and Quarry*, April 20, 1924.

Special Note: High alumina brick have been eminently successful in rotary kilns used for dead-burning dolomite. In one instance substitution of a diaspore refractory of the following analysis, for magnesite kiln liners, reduced the maintenance cost to a negligible quantity, where previously the expense of lining replacement and interruption to kiln service had almost made the operation impossible from an economic standpoint. Representative analysis of the brick used is Al_2O_3, 82.52; SiO_2, 12.08; Fe_2O_3, 1.50; CaO, 0.11; MgO, 0.22; Alk., 0.54; TiO_2, 3.01.—Ed.

The question of storage of refractories has been brought to the attention of this department. What effect does dampness, or water have on brick if they are allowed to absorb and hold it for an indefinite time before use? (This query does not take in the matter of freezing. Everyone knows that a brick is badly damaged when frozen.)

Does water dissolve, or otherwise destroy, the bond clay in a refractory brick? What is the effect on the service of the brick that has been soaked with water indefinitely?

If a brick stands for a time exposed to the weather, and becomes soaked with water, are there any gases present in the average consuming plant which permeate the atmosphere of the yards, which will be absorbed in the water-soaked brick and reduce its ability to stand service? What about sulphur fumes, flue gases, and flue dust?

Can a brick so permeated with water be successfully dried out before laying? After laying? (Most brick layers wet the brick before laying although very little water gets into the pores of the brick. Furnace operators say they start a furnace slowly to dry it out. Do they start it slowly enough?)

If you have any data on the above questions, jot it down and send it along. The

sales force and sales engineers of every fire-brick organization should be consulted on this question and information contributed may help to bring to the consumer the necessity of providing adequate dry storage for his refractories. It will help the fire-brick manufacturer for him to do this, and many complaints will be eliminated.

The consumer has plenty of data on this if he can be made to talk. Get hold of him and find out what he thinks.

C. S. Gantt, purchasing agent of the Baltimore Copper Smelting and Rolling Company, one of the country's foremost advocates of methods by which the consumer can get out of the brick all there is in it, recently contributed an article, "Essential Factors Which Increase Life of Refractories." [1] His article touches the handling and storage in a very complete manner, and he stresses the necessity of keeping refractories in dry storage and states that "exposure deteriorates bond and weakens structure."—Ed.

[1] *Ceram. Ind.*, October, 242–44(1924).

ACTIVITIES OF THE SOCIETY

SUMMER MEETING HELD IN LOS ANGELES

Seventy-two members and guests of the AMERICAN CERAMIC SOCIETY attended the one-day session held at the Biltmore Hotel, Los Angeles, California, October 6, 1924. The following program[1] was given at the morning and afternoon meetings and at seven o'clock a banquet was served.

Morning Session

1. Opening Address .... Ross C. Purdy
General Secretary, AMERICAN CERAMIC SOCIETY
2. Tableware on the Pacific Coast .... W. G. Jackson
3. Artificial Sillimanite as a Refractory[2] .... Hewitt Wilson
University of Washington
4. Synthetic Sillimanite in Ceramic Bodies .... T. S. Curtis
5. Overhead Transportation in a Clay Plant ....
Eng. Dept., Los Angeles Pressed Brick Co.

Afternoon Session

6. Cast Iron Enamels (with microphotographs) .... A. Malinovszky
7. Seger's Rules for Control of Glazes .... Ross C. Purdy
8. Notes on Terra Cotta Body Shrinkage .... P. G. Larkin and E. R. Curry
9. Notes on Development of Vitreous Slips for Terra Cotta ....
H. E. Davis and J. S. Lathrop
10. Tunnel Kilns .... E. W. Ekstrand
11. Construction of Kiln Crowns .... John Sawyer

Evening

Banquet at Hotel Biltmore .... 7:00 P.M.
Address by F. S. Laurence, Executive Secretary, National Terra Cotta Society
Entertainment Features:

Tuesday, Wednesday and Thursday, October 7, 8, and 9 were given over to plant visitations with the following itinerary.

Northern section under the chairmanship of Benjamin Cake, General Superintendent of the Los Angeles Pressed Brick Company. The following plants were visited:

Los Angeles Pressed Brick Co., Plant 1
Batchelder Wilson Company
Tropico Potteries, Inc.
Empire China Co.
Pacific Clay Products Co., Plant 4

The southern trip under the guidance of T. S. Curtis, President of the Vitrefrax Company, covered the plants of the

Washington Iron Works
Whiting Mead Pottery Co.
The Vitrefrax Co.
California Clay Products Co.
American Grinding Company
The Los Nietos Plant of Pacific Clay Products Co.

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[1] These papers will be published in forthcoming issues of the *Journal*.

[2] Part I published in November *Journal*.

On Thursday an excursion was made to the deposits and plant of the Celite Products Company at Lompoc, California, under the guidance of C. A. Muketta.

The registration of attendance at the first day's session was as follows:

Name	Representing	Location
H. B. Potter	L. A. Pressed Brick Co.	Los Angeles
H. E. Davis	Tropico Potteries, Inc.	Glendale
S. Aronson	The Vitrefrax Co.	Vernon
J. L. Davies	Pacific Clay Prod., Inc.	Los Angeles
H. A. Huisken	The Vitrefrax Co.	Vernon
H. J. Knollman	The Vitrefrax Co.	Vernon
J. H. McKnight	Craycroft McKnight Co.	Fresno
F. L. Drinkwater	*Brick and Clay Record* *Ceramic Industry*	Los Angeles
Gregory L. Rogers		Los Angeles
John S. Lathrop	Tropico Potteries	Glendale
E. W. Ekstrand	Cons. Engineer	Los Angeles
T. A. Klinefelter	Gladding, McBean & Co.	Lincoln, Calif.
Geo. Brian	Paper Makers Importing Co.	Easton, Pa.
Finlay Drummond	The Vitrefrax Co.	Los Angeles
Karl Hart	The Vitrefrax Co.	Los Angeles
Rollin L. Lee	Abbé Engineering Co.	Los Angeles
B. C. Berg	Schurs Oil Burner Co.	Los Angeles
C. A. Muketta	Celite Products Co.	Los Angeles
L. F. Barber	Southwestern Eng Corp.	Los Angeles
Morgan D. Lalor	L. A. Pressed Brick Co.	Los Angeles
Edw. W. Koskinen	L. A. Pressed Brick Co.	Los Angeles
Elmer H. Ockerman	L. A. Pressed Brick Co.	Los Angeles
B. M. Burchfiel	Pacific Clay Prod., Inc.	Los Angeles
Frank C. Schultz	L. A. Pressed Brick Co.	Alberhill
J. L. Greenwood	L. A. Pressed Brick Co.	Alberhill
Robert C. Zehm	L. A. Pressed Brick Co.	Alberhill
Frank R. White	L. A. Pressed Brick Co.	Santa Monica
Fred O. Wanka	L. A. Pressed Brick Co.	Los Angeles
B. F. Cake	L. A. Pressed Brick Co.	Los Angeles
A. Malinovszky	Washington Iron Works	Los Angeles
Ross C. Purdy	American Ceramic Society	Columbus, Ohio
Fred B. Ortman	Tropico Potteries, Inc.	Glendale
T. S. Curtis	The Vitrefrax Co.	Los Angeles
P. J. McGuire	Kennard Eng. Co.	Los Angeles
W. E. Burke	American Trona Corp.	Trona, Calif.
D. C. Newmarch	L. A. Chamber of Commerce	Los Angeles
Edw. Reynolds	Santa Barbara Brick Co.	Santa Barbara
R. W. Ellison	The Vitrefrax Co.	Los Angeles
C. J. Phillips	N. Clark and Sons	Alameda, Calif.
G. D. Clark, Jr.	N. Clark and Sons	Alameda, Calif.
Paul G. Larkin	Gladding-McBean Corp.	Lincoln, Calif.
H. W. Weber	Russell Eng. Co.	St. Louis, Mo.
G. R. Boggs	Empire China Co.	Los Angeles
W. A. Potter	Pacific Sanitary Mfg. Co.	Richmond, Calif.
W. H. Hunt	Westinghouse High Voltage Insulator Co.	Oakland


California Section of American Ceramic Society
The Los Angeles Biltmore Oct 6 1924

J. W. Moncrieff	Stockton Fire Brick Co.	Stockton, Calif.
V. R. Sullivan	Stockton Fire Brick Co.	Stockton, Calif.
C. Massey	Amer. Encaustic Tile Co.	Los Angeles
Thomas C. Walker	L. A. Pressed Brick Co.	Los Angeles
A. L. Gossman	Celite Products Co.	San Francisco
C. F. Moss	Celite Products Co.	Los Angeles
J. R. Allison	Celite Products Co.	Whittier
Gus Larson	L. A. Pressed Brick Co.	Los Angeles
G. J. Poxon	Poxon Pottery	Vernon, Calif.
C. E. Smoot	Smoot-Holman Co.	Inglewood, Calif.
H. H. Coors		Los Angeles
C. R. Minton	L. A. Pressed Brick Co.	Los Angeles
John Sawyer		Los Angeles
Arthur D. Storke	Kingman Feldspar Co.	Kingman, Ariz.
Raymond W. Ager	So. Calif. Edison Co.	Los Angeles
Chas. J. Biddle	Alberhill Coal & Clay Co.	Los Angeles
R. B. Keeler	Calif. Clay Prod. Co.	Los Angeles
Jno. F. Keenan		San Diego
F. Baddeley	Lincoln High School	Los Angeles
H. S. Kirk	Universal Sanitary Mfg. Co.	New Castle, Pa.
F. A. Moore		St. Louis, Mo.
F. H. Riddle	Champion Spark Plug Co.	Detroit, Mich.
Wm. G. Jackson, Jr.	Empire China Co.	Burbank, Calif.
W. L. Balderston	Pacific Scientific Co.	Los Angeles
Max C. Compton	L. A. Pressed Brick Co.	Los Angeles
H. W. Shepard	L. A. Chamber of Commerce	Los Angeles
F. S. Laurence	Amer. Terra Cotta Assoc.	New York, N. Y.

The Executive Committee for the meeting was composed of

F. B. Ortman........Chairman
Finlay Drummond........Treasurer
C. Berg........Hotel Arrangements
H. E. Davis........Program and Registration
T. S. Curtis........Southern Trip
B. F. Cake........Northern Trip

A. Malinovszky — Robert Linton
F. O. Wanka — Gus Larsen
Ray Boggs

NEW MEMBERS RECEIVED FROM SEPTEMBER 15 TO OCTOBER 15

PERSONAL

Boedicker, Earl O., 165 N. Portage Drive, Akron, Ohio, Sales Manager, Maurice A. Knight Co.

Cox, James, 6227 Reber Place, St. Louis, Mo., Engineer, Russell Engineering Company.

Dennison, Charles S., 1522 Malasia Road, Akron, Ohio, Superintendent, Maurice A. Knight Co.

Dowling, Guy E., 28 W. Atlantic St., Warren, Ohio, President, The Warren Engineering Co.

Fisk, Henry G., U. S. Bureau of Mines, Lord Hall, O. S. U., Columbua, Ohio.

Godard, Ray S., Box 40, Montreal, Canada, Works Manager, Consumers Glass Co., Ltd.

Goshorn, Robert R., Jr., Clay City, Ind., Indiana Brick & Tile Corp.

Hall, Edwin J., 212 N. 2nd St., Jeanette, Pa., Plant Chemist, American Window Glass Co., Factory No. 2.

Irish, William E., Erie City Iron Works, Erie, Pa., Works Engineer.

Jllgen, F., Bobrek O.-S. Julienhütte, Versuchsanstalt, Germany, Director of Research.

Luckie, John Barton, 509 Oliver Bldg., Pittsburgh, Pa., District Manager, Refractories Sales, E. J. Lavino & Co.

Maloney, Michal, 804 College Ave., Cleveland, Ohio.

Richardson, John W., Ingram-Richardson Mfg. Co., Frankfort, Ind., Superintendent.

Sherman, Ralph A., 4800 Forbes St., Pittsburgh, Pa., Assistant Physicist, Bureau of Mines.

Slagle, Edgar A., Box 88, Trenton, N. J., General Manager, Acree Colloidal Chemical Co.

Stewart, J. H., Box 258, Canton, Ohio, Assistant General Manager, The Stark Brick Co.

Westman, Albert E. R., Dept. of Ceramic Engineering, University of Illinois, Urbana, Ill., Research Associate.

CORPORATIONS

Federal Electric Company, 8700 S. State St., Chicago, Ill. Lee Hall, Representative.

The Westport Paving Brick Co., Westport, Baltimore, Md. John W. Hall, Representative.

Membership Workers' Record

	Personal	Corporation		Personal	Corporation
A. W. Buckingham	1		C. W. Parmelee	1	
Paul E. Cox	1		L. V. Reese	1	
J. W. Cruikshank	1		N. L. Schneider	1	
K. Endell	1		Leonard Sheerar	1	
Andrew Foltz	1		Office	4	1
Herbert Goodwin	1			—	–
M. A. Knight	2		Total	17	2
R. D. Landrum	1	1			

ANNOUNCE PROGRAM FOR ST. LOUIS SECTION[1]

The Executive Committee of the St. Louis Section, consisting of F. E. Bausch, *Chairman*, G. E. Thomas, C. W. Berry, and L. C. Hewitt, recently met to outline a plan of action for the coming Fall and Winter Sessions. Many good things are in prospect for the meetings. The coöperation and attendance of all the members is urged so that these meetings may be of utmost value to every one concerned.

The prospective program is:

October.—On October 28, the Section met jointly with the American Institute of Architects at the Architectural Club, Washington University, at which time matters of mutual interest to ceramists and architects were discussed. An exhibit of unusual interest was displayed.

November.—On November 25, it is planned to devote a special meeting to the subject of enamels. Every enamel man should be present. This meeting will also be of

[1] L. C. Hewitt, Secretary, St. Louis Section.

great interest to other than enamel producers as such subjects as enamel furnaces will be discussed and an exhibit of enameled products will be on hand.

January.—An outline of the rôle that Industrial Laboratories, such as Arthur D. Little, Inc., and Mellon Institute play in the development of the ceramic industry.

February.—The manufacture of plate glass, illustrated.

March.—Oil burning for ceramic kilns.

April.—The manufacture of lead pencils.

PITTSBURGH SECTION ELECTION[1]

At a meeting of the Pittsburgh Section of the AMERICAN CERAMIC SOCIETY held in the Mellon Institute on October 3, 1924, H. Foster Robertson was elected Secretary to take the place of Mr. Schurecht, who resigned on account of his having accepted a position with the Bureau of Standards in Washington. J. Spotts McDowell was elected as Vice Chairman.

The meeting discussed programs and the policy of the SOCIETY for local meetings.

MEETING ON OCTOBER 20

Members of the Pittsburgh Section of the Society held a meeting on October 20 at which time the following addresses were made: Walter Kennedy of the Celite Products Co. gave a paper on "Kiln Insulation;" W. K. Brownlee of the Buckeye Clay Pot Co., Toledo, Ohio gave an address on "The Effect of Insulation on Flux Line Blocks in Glass Melting Tanks."

PACIFIC NORTHWEST CLAYWORKERS' ASSOCIATION AND LOCAL SECTION OF THE AMERICAN CERAMIC SOCIETY[2]

The summer meeting of the Pacific Northwest Clayworkers' Association and Local Section of the AMERICAN CERAMIC SOCIETY was held in Spokane, Sept. 26 and 27. On the first day the visitors from Seattle, Portland, Yakima, Mead, Clayton, Auburn, Granger and Troy, Idaho were taken by auto to visit the kaolin, fire brick, face brick and sewer pipe clay pits and plants of the Washington Brick, Lime and Sewer Pipe Co., and the American Fire Brick Co.'s plants at Mica, Spear and Clayton.

Thirty attended the meeting at the Hotel Davenport the following day to discuss the subject of marketing clay products. F. T. Houlahan, chairman, presided. Victor Piollett, vice-president of the Washington Brick, Lime and Sewer Pipe Co., explained the difference between dealers' merchandising methods in the west and in the east, pointing out that in the west the manufacturers had to sell their own products with little or no aid from other agencies. A big selling point, he said, was to inject the human touch such as displaying the samples attractively and gaining the confidence and approval of architects and builders.

P. S. MacMichael, Northern Clay Co., Auburn, Washington, spoke on "Quality." He condemned price-fixing as harmful to the industry and to the public. He emphasized the need for all manufacturers to strive for quality in their products and for conducting business on a higher plane. "One of the best selling arguments," he said, "will come from the good words passed from mouth to mouth by satisfied users."

An address on "Service" was given by Bertram D. Dean, manager of the P. N. W. Brick Manufacturers' Association, Seattle.

[1] J. W. Cruikshank, Chairman.

[2] Hewitt Wilson, Secretary.

A. B. Fosseen, President of the Washington Brick, Lime and Sewer Pipe Co., declared manufacturers must help one another and praised the association and its purpose. He stated that there was no need to fight competitors but instead, show the public the superiority of the clay products. He stressed the importance of giving the consumer the best under all circumstances and asserted that the time was coming when the clay industry would be a more vital factor in the community.

Hewitt Wilson, University of Washington, spoke briefly on the necessity of intensive advertising and service to the small builder.

The afternoon session was followed by a banquet at the Hotel Davenport Saturday evening with Mr. Fosseen acting as toastmaster.

PACIFIC NORTHWEST SECTION MEETING

Twenty-five members of the Pacific Northwest Section of the American Ceramic Society met for a noon luncheon on Oct. 17, in the L. C. Smith Building Restaurant, Seattle, Wash., to hear Mr. Ross C. Purdy, General Secretary of the American Ceramic Society, talk on the development and work of the American Ceramic Society.

Mr. and Mrs. Purdy are touring the Pacific Northwest as they return from the recent ceramic meeting in Los Angeles. They have visited the ceramic plants in both Portland and Seattle, the Ceramic Engineering Department at the University of Washington, have taken the beautiful Columbia River Highway drive and have seen the beauties of the Seattle boulevards, lakes and Mt. Rainier.

Those present at the noon day luncheon were: Paul S. MacMichael, Northern Clay Co., A. L. Bennett, Northern Clay Co., F. T. Houlahan, C. L. Houlahan and Arthur Houlahan, Seattle Brick Tile and Delivery Co.; R. A. Swain, Sam Geijsbeek, H. B. MacMillan, Olaf Olsen, of the Denny Renton Clay and Coal Co., Hewitt Wilson, R. D. Reed, M. L. Brandenbury, Hobart Goodrich, M. C. Reynolds, J. R. Gednetz from the Ceramic Department, Univ. of Washington, W. E. Clark, Washington Brick Lime and Sewer Pipe Co., T. S. Lippy, Harper Brick and Tile Co., A. B. Storey, Bothell Brick and Tile Co., H. W. Beecher, Charles C. Moore Co., J. O. Hankins, Seattle Pottery Co., S. L. Glover, Landes and Glover, Geologists, C. E. Curtis, U. of W., George Stirrat, Seattle Brick and Tile Co.

Hewitt Wilson, *Secy.*

REPORT OF RENSSELAER CENTENNIAL

L. E. Barringer, who acted as representative for the American Ceramic Society at the Centennial Celebration at Rensselaer Polytechnic Institute, Troy, N. Y., October 3–4, has presented his official report of the meeting. Mr. Barringer states: "The Society is constantly becoming better known and that representation at such events is highly desirable in maintaining our place among scientific organizations."

Mr. Barringer was among the 227 delegates representing educational institutions and scientific organizations from all over the world.

Among the speakers on the general program were the following men representing educational institutions and technical societies.

Herbert C. Hoover, Secretary of Commerce of the United States
Frank P. Graves, President, University of the State of New York
Sir Charles L. Morgan, President, Institution of Civil Engineers of Great Britain
Henri Abraham, Past President, Society of Electrical Engineers of France
Luigi Luiggi, President, Society of Civil Engineers of Italy
Arthur Surveyer, President, Engineering Institute of Canada

Palmer C. Ricketts, President, Rensselaer Polytechnic Institute
Livingston Farrand, President, Cornell University
James R. Angell, President, Yale University
Edward A. Birge, President, University of Wisconsin
Samuel W. Stratton, President, Massachusetts Institute of Technology
Albert A. Michelson, President, National Academy of Sciences
Carl E. Grunsky, President, American Society of Civil Engineers
Frederick R. Low, President, American Society of Mechanical Engineers
William Kelly, President, American Institute of Mining and Metallurgical Engineers
Farley Osgood, President, American Institute of Electrical Engineers.

CHROME REFRACTORIES BIBLIOGRAPHY

L. J. Trostel, Chairman, Committee on Data, Refractories Division, has recently undertaken the compilation of a bibliography of articles dealing with chrome refractories. He has requested that any one keeping card index references on this subject communicate with him, so that a check may be made on the list which he has in hand.

Much interest is being shown in the bibliographies which are being issued by the Refractories Division. The Magnesite and Silica Bibliographies have been ditributed and the bibliography on Clay Refractories under the direction of R. F. Ferguson has been compiled in preparation for printing.

NOTES AND NEWS

FALL ACTIVITIES IN CERAMIC SCHOOLS

All Show Increase for 1924–25

In reply to a questionnaire recently sent out from the office of the Editor to the various Ceramic Departments of the Universities of this country, figures show that there is a widespread and increasing interest in educational growth in ceramics. Every one of the older schools reports an increase in number of students, a development of courses and additions to resources and equipment. Two schools are reporting students for the first time in their newly organized departments.

Alfred University leads in the number of Senior students, reporting 24, with 19 at Ohio State University and 15 at the University of Illinois.

The reports from the heads of the Ceramic Departments follow:

Ohio State University

	1923	1924
Post graduates	3	3
Seniors	6	19
Juniors	17	26
Sophomores	28	34
Freshmen[1]	14	17
	—	—
	68	99

[1] Freshmen do not register in any particular department but may indicate their intention. Hence the Freshmen register is never complete.

The Senior class consists of:

Ammon, M. G.
Arnold, T. M.
Austin, J. S.
Bozman, W. D.
Doll, C. E.
Franz, L. J.
Gould, Robert
Grady, G. M.
Lepper, A. E.
Lower, D. E.
Mayfield, C. C.
Porter, P. W.
Senn, W. E.
Simpson, H. E.
Stull, Francis
Westendick, F. C.
Burkhalter, Edward
Clawson, C. D.
Merrett, C. W.

Prof. C. B. Harrop having resigned, it was necessary to obtain a teacher for Ceramic Engineering, Design and Construction, and Prof. R. C. Sloane of the Civil Engineering Department was secured for one year at the end of which a permanent appointment will be made.—By A. S. WATTS, Professor, Dept. Ceramic Engineering.

University of Illinois

	1923	1924
Freshmen	27	28
Sophomores	15	26
Juniors	18	20
Seniors	18	15
Special	1	
Graduate Students	6	6
Total	85	95

List of Senior students:

Abney, Charles L.
Bopp, Harold F.
Bradley, Richard S.
Fels, Clarence G.
Foster, Edwin S.
Grigsby, Chester E.
Grout, Jack R.
Halloin, William G.
Innes, David H.
Lampe, Chester E.
Levystein, Alan
McNair, Francis G.
Parmelee, Cullen E.
Schoreder, Geo. C.
Whitney, Wm. Percy

New Instructors

Dr. A. E. R. Westman, a graduate of the University of Toronto has been appointed Research Associate. W. H. Pfeiffer, E. P. Wright and A. J. Paul have been appointed to assist in the research program on refractories and porcelain. Six Public Utilities companies in the northern part of Illinois have provided funds for research on electrical porcelain and refractories. The total amount which has been provided is $12,500 each year for two years.

The Titanium Alloys Manufacturing Company of New York has provided funds for research on metal enamels. This investigation as planned is to be conducted during the next two years.—By CULLEN W. PARMELEE, Professor and Head of Department.

The New York State School of Clay-Working and Ceramics at Alfred University

	1923–24	1924–25
Seniors	22	24
Juniors	27	19
Sophomores	22	31
Freshmen	37	46
Specials	3	9
Total	111	129

Senior Students, 1924-25

Engineering	Applied art
Orray T. Fraser	Elizabeth Burdick
George H. Garnhart	Gertrude R. Burgess
Stoneson Grant	Eleanor E. Craig
Leslie F. McConnell	Clarice C. Davis
Henry E. Marley	Ada R. Mills
David W. Miller	Hazel M. Niver
Remington M. Murphy	Margaret L. Prentice
Marvin H. Pond	Ruth D. Whitford
Harold M. Rice	Mary Alma Wise
Harold T. Rogers	
Frederick M. Strate	
Stephen M. Swain	
We Wei Tsou	
Herman Tuckman	

Dr. A. I. Andrews has been appointed Professor of Ceramic Engineering and Neal C. Welch has been made laboratory assistant. The new courses offered include Ceramic Geology and Mineralogy and Power and Machinery.—By C. F. Binns, Director,

Iowa State University

The total enrollment for 1924–25 is 31, an increase of 9 over 1923–24. There are 9 Freshmen enrolled, and 3 Seniors, one completing the course at the end of the Winter Quarter. Among the students is one from British India and one from the Philippines.

Additional space has been added to the Department, doubling the space occupied last year.

Miss Mary Lanier Yancey, of the H. Sophie Newcomb Memorial College, Tulane University, New Orleans, has been added to the Department to handle the work in art pottery.—By Paul E. Cox, Dept. of Ceramic Engineering.

University of Washington

There are 7 students this year, with one, M. E. Reynolds, a senior. Three were graduated last year: H. C. Fisher, now with Norton Co., Worcester, Mass., Wallace Thoreseon, Washington Brick, Lime and Sewer Pipe Co., Spokane, and Hilding Johnson, Denny Renton Clay and Coal Co., Seattle.—By Hewitt Wilson, Ceramic Engineering.

Pennsylvania State College

First registration: Freshmen 2, Sophomores 4, Juniors 1.—By J. B. Shaw, Professor of Ceramic Engineering.

Georgia School of Technology

First registration limited to Sophomore students this year with 4 enrolled. The building is nearing final stages of completion and will be occupied at once.—By A. V. Henry, Dept. of Ceramics.

DR. GRANGER ELECTED TO CHAIR OF CERAMICS

M. Albert Granger, Docteur Ès-Sciences, of La Manufacture Nationale de Sèvres, writes under date of September 22 that he has been elected to the Chair of Ceramics n Le Conservatoire National des Arts et Metiers. Dr. Granger states that he will

have his laboratory as formerly at the factory at Sèvres. The work at the Conservatoire will have to do with ceramic materials, cements and mortars. Dr. Granger has always been ambitious to add to his activities as an educator and this new position expands opportunity in that field for him, not forgetting the added work he will be able to do in research fields. He states that many improvements have been made in the always adequate laboratories at Sèvres.

NECROLOGY

Announcement has been received of the death of William G. Stevenson, on August 21, 1924. Mr. Stevenson was general manager and treasurer of the National Silica Co., Oregon, Illinois. Mr. Stevenson had been a member of the AMERICAN CERAMIC SOCIETY since 1906.

LENOX, INC., ISSUES FREE FILM

Lenox, Inc., Trenton, N. J., announces a free moving picture film for educational purposes, showing every process in making Lenox China. This film was issued on October 1, 1924. Museums, schools, women's clubs, etc., interested in obtaining this film should communicate with J. Alexander Leggett, 1476 Broadway, New York City.

BROADCASTING TALKS ON CHEMISTRY BY RADIO

Six talks on "The Rôle of Chemistry in Every-Day Life" will be broadcast from the University of Pittsburgh radio studio of KDKA, of the Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pa., according to an announcement from the University. These talks, which have been especially prepared by members of the University's Department of Chemistry, are scheduled for 8:15 P.M. each Wednesday evening, as follows:

October 8, "The Place of Chemistry in Every-day Life," by Alexander Silverman, M.S., head of the Department of Chemistry.

October 15, "The Air We Breathe and the Water We Drink," by Kendall S. Tesh, Ph.D., instructor in inorganic chemistry.

October 22, "The Food We Eat," by Charles G. King, Ph.D., professor of sanitary chemistry.

October 29, "Coal: A Factor in Industry and Health," by Alexander Lowy, Ph.D., professor of organic chemistry.

November 5, "Heat and Cold: What They Mean to Us," by Gebhard Stegeman, professor of physical chemistry.

November 12, "Glass: One of Man's Blessings," by Alexander Silverman.

Syllabi containing outlines of the lectures, reading references, and questions for the purpose of supplementary study have been printed and are available at a cost of twenty cents. These may be obtained by addressing The Radio Manager, University of Pittsburgh, Pittsburgh, Pa.

CORRECTION TO LIST OF GEOLOGISTS

The following corrections have been issued for the "List of State Geologists"[1] issued recently.

Arkansas. Geo. C. Branner, State Geol., Fayetteville, Ark.

[1] *Bull. Amer. Ceram. Soc.*, **3** [7], 267(1924).

California. Lloyd L. Root, Ferry Bldg., San Francisco, Calif.
Idaho. Idaho Bur. Mines and Geol., Dean Francis A. Thomson, Moscow, Idaho.
North Dakota. Prof. A. C. Leonard, State Geol., Grand Forks, N. D.
New Jersey. H. B. Kümmel, State Geol., Trenton, N. J.
Minnesota. Dr. W. H. Emmons, University of Minn., Minneapolis, Minn.
Oregon. I. A. Williams, Director, Hood River, Oregon.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924–Jan. 3, 1925	Washington, D. C.
Am. Assn. of Flint and Lime Glass Mfrs. (Annual Meeting)	July, 1925	Atlantic City, N. J.
Am. Concrete Institute	Feb. 24–27, 1925	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
The American Institute	Dec., 1924	New York City
Am. Inst. of Chemical Engrs.	Dec. 3–6, 1924	Pittsburgh, Pa.
Am. Society of Mech. Engrs.	Dec. 1–4, 1924	New York City
Common Brick Mfrs. Assn.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Exposition of Inventions	Dec. 8–13, 1924	New York City
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Manufacturing Chemists' Assn.	June, 1925	New York City
Mining & Met. Society of America	Jan. 13, 1925	New York City
Natl. Academy of Sciences	Nov. 10–12, 1924	Cambridge, Mass.
Natl. Assn. of Mfrs.	May, 1925	New York City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Exposition of Power & Mech. Engrs.	Dec. 1–6, 1924	New York City
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
National Lime Association	May, 1925 (?)	
N. J. Clayworkers' Assn. and E. Sect. of the American Ceramic Society	Dec., 1924	New Brunswick, N. J.
Taylor Society	Dec. 4–6, 1924	New York City
Tenth Exposition of Chem. Industries	Sept. 28–Oct. 3, 1925	New York City
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Mfrs. Assn.	Jan., 1925	Kansas City, Mo.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Vol. 3 | December, 1924 | No. 12

EDITORIAL

THIRTY YEARS OF COÖPERATIVE CERAMICS

From prehistoric times ceramic wares have been essential to man's welfare. He builded his abodes, fashioned his utensils, expressed his art and recorded his achievements in clay and glass. With civilization, ceramics advanced and retarded. With changes in local ideals and customs ceramics changed, but the art of ceramics and ceramics as the medium of art expression was at no time lost to the world; each advance was permanent. Utility and art were never divorced. With the discovery that clay could be fashioned and its form made permanent by firing, clay vessels were home utensils and home utensils were home decorations. Glass may have been formed first by chance but it was not by chance that the history of glass-making parallels the history of art and civilization. Ceramic wares have in all ages been essential to man's material and spiritual welfare, but their production was by individuals, each building into his ware his own art inspirations.

Until very recently man was almost wholly individualistic; each was for self. Survival of the fittest was the motivating slogan; coöperation was unknown.

Coöperation became more and more essential as man emerged from serfdom and slavery, and as he produced more and more of what he did not himself consume. Individualism has grown apace with collectivism for no man

can shift onto others his responsibility for self-expression and self-attainments, but man can no longer advance self either at the expense of his fellows, or without his fellows' aid. The complexity of and democracy in human affairs makes it advantageous for men to coöperate. No one in these days has the time and the ability to accomplish or to comprehend all phases of the affairs with which he must now be concerned. This has led to specialization in effort and to coöperation. Coöperation is more selfish than it is altruistic. Coöperation is absolutely essential to an individual's industrial welfare. Coöperation emphasizes individualism, for by coöperation the resources of each individual are manifolded.

As industrial ceramics developed there has been more and more dependence on the coöperation of specialists. No persons working alone could make and market any other than the simplest ware on the smallest possible production basis. Modern production is now on a tonnage basis but with no less demand for quality and art.

Within the last few decades industrial ceramics has developed the demand for specialists who can translate ceramic problems into terms of the fundamental sciences and can keep ceramic science apace with the rapidly growing wealth of scientific facts. This demand brought into existence the modern ceramic schools.

Only thirty years have passed since the world's first collegiate department of ceramic engineering was established. The organizing of the American Ceramic Society was the next expression of the industrial demand for coöperative development of individuals. Specialists are essentials in the present industrial scheme of affairs, but specialists without an organized means of coöperation would retard rather than progress industrial development.

Coöperation in ceramics is not the carping of an idealist nor the dream words of the altruist; it is the fact realization of those who have builded wisely and largely. It pays individuals to work in the ways provided by the American Ceramic Society.

PAPERS AND DISCUSSIONS

REFRACTORIES QUESTION BOX

E. E. AYARS, EDITOR

Question

What simple laboratory tests can be used to keep the quality of refractories up to standard?

Discussion

The simplest test which can be used in a fire-brick plant to maintain the quality of the product is a reheating of the brick to a high temperature. The equipment is simple and easy to operate. A furnace having a combustion chamber about 18 inches each way can be built from brick which are at hand. Kerosene or fuel oil can be used, and a low-pressure burner, preheating coil, and a small blower and motor is all the equipment which it is necessary to purchase. Two hundred dollars should cover the complete investment.

The test consists in placing the brick on end in the furnace and running the heat for five or six hours. Cone 18 is sufficiently high to give an indication of the quality of many brick, but such a furnace should be capable of attaining cone 26.

With most clays, iron is the insidious enemy, and any marked increase in iron content will be quickly shown by the spots developed in the test. A decrease in the refractoriness of the bond clay will be shown by excessive vitrification or by overfiring. An abnormally coarse grind will cause the brick to squat prematurely, and an abnormally fine grind will be shown by early vitrification. Underfired brick will shrink excessively, and inferior clay will swell. Sandy clay will cause the brick to crack.

This reheating is preferable to a fusion test because it is easier to make in the average plant and requires less equipment. Furthermore, it will give more information. A fusion test should also be run at intervals, both on the clay and the brick, but most plants will find that this can be done more cheaply and more accurately at a properly equipped testing laboratory than at the plant. A reheating to cone 20 of brick from different sources, will usually leave no doubt as to which is the superior refractory."—ROBERT F. FERGUSON, Garfield Fire Clay Company.

Question

Will the use of "super-refractories" in boiler furnace work become general?

Discussion

My position on the matter of boiler refractories may be briefly summed

up as follows:[1] While there will undoubtedly be a limited demand for the so-called super-refractories which some of the manufacturers are producing at this time (in other words, refractories capable of withstanding upwards of 3500°F) the prices at which such material is offered make its use prohibitive in ordinary boiler construction and it is up to the user of fire brick to so construct his furnaces that the ordinary first grade refractories will function in a satisfactory manner. The results of this extensive investigation which I have made among large users of fire brick indicate that refractories rarely fail directly from fusion, the main cause of failure being the action of molten slag on the walls which enters the spaces between brick and the pores of the brick itself, causing the refractory particles to form a eutectic with the slag and flow away. This difficulty is very largely accentuated by the fact that the fire brick ordinarily furnished vary in dimensions through considerable limits, making necessary the use in some cases of comparatively large joints; and it is the feeling of the users that the greatest opportunity for improving the quality and increasing the life of commercial refractories lies in greater uniformity of dimensions. This point cannot be too strongly emphasized and it is a matter which has been repeatedly brought to the attention of the manufacturers so far with little in the way of definite results, and I would urge upon your SOCIETY the importance of impressing upon the manufacturers to so regulate their processes of manufacture that the fire brick to be used in furnace linings will have sufficient uniformity in dimensions to permit their being laid up with the use of a minimum of bonding material between courses.

Question

What do you find in the Question Box which has caused you to read to this point? If you have found anything of value during the past few months, it is highly probable that you can contribute questions and discussions that will be interesting to the other readers. Won't you sit down and frame your questions and discuss them. The Editor does not believe that his situation carries with it the duty of writing many discussions of such questions as are put, but rather the selection and compilation of discussions forwarded to him by the readers. Some readers have been very good about making contributions, but we need other viewpoints and experience, and various methods of expression. Address the Editor, care of the General Secretary.

[1] The following extract from personal correspondence was written by an engineer of several years' experience in power plant refractory problems, and at present working with no less than three national associations on the problem of proper boiler furnace refractories.

ACTIVITIES OF THE SOCIETY

NEW MEMBERS RECEIVED FROM OCTOBER 15 TO NOVEMBER 15

PERSONAL

Anwyl, Robert H., 215–15th Ave., Columbus, Ohio. Student.

Crandall, J. Ralph, 118–14th Ave., Columbus, Ohio. Student.

Eberle, William S., Box 25, Williamstown, W. Va. Secretary and Treasurer, The American Bisque Co.

Hall, John W., 3rd, 2124 Mt. Royal Terrace, Baltimore, Md. Westport Paving Brick Co.

Hayward, Claude C., 6186 Westminister Place, St. Louis, Mo. General Refractories Co.

Johnson, Gustaf A., 612 W. Main St., Maryville, Tenn. Technical Staff, Aluminum Co. of America., Alcoa, Tenn.

Kirk, Brenton S., New Philadelphia, Ohio. Superintendent, The Belmont Stamping & Enameling Co.

Lower, Donald E., 1942 Iuka Ave., Columbus, Ohio. Student.

Morgan, James W., Jackson, Ohio. Secretary-Treasurer, The Morgan Horton Clay Co., Eifort, Ohio.

Smith, Kenneth M., 213 N. 11th St., Cambridge, Ohio. Ceramic Engineer, Cambridge Sanitary Mfg. Co.

Yancey, Mary L., 304 Russell Ave., Ames, Iowa. Instructor in decorative pottery at Iowa State College.

CORPORATION

Hartford-Empire Company, Box 1411, Hartford, Conn. F. Goodwin Smith, Vice-President.

Stettiner Chamottefabrik Akt.-Ges. vorm. Didier, Stettin, Schwarzer Damm 1 u. 13 a., Germany.

Membership Workers' Record

	Personal	Corporation
George A. Balz		1
Paul E. Cox	1	
J. C. Hostetter		1
R. K. Hursh	1	
F. G. Jackson	1	
L. W. Manion	1	
Office	7	
Total	11	2

MEETING OF PORTLAND CERAMISTS

On Friday evening, October 16, two dozen Portland, Oregon clayworkers and friends assembled at an informal dinner in the Multnomah Hotel, one of Portland's leading hostelries. This gathering was complimentary to Mr. and Mrs. Ross C. Purdy of Columbus, Ohio, at the end of their two-days' visit to this most attractive and thriving seaport of the Pacific Northwest.

Secretary and Mrs. Purdy were on their return trip to Columbus from attendance at the Summer Meeting of the AMERICAN CERAMIC SOCIETY in Los Angeles, October 6 and 7. Wednesday and Thursday, October 15 and 16, were spent in Portland. The first of the two days was devoted entirely to seeing the city and to an automobile ride of a little less than one hundred miles over one of the most scenic portions of the celebrated Columbia River Highway. This highway is a paved boulevard for close to two hundred miles through the depths of the canyon of the Columbia River. The party was piloted on this day by Raymond R. Smith, of the Denny-Renton Clay and Coal Company, M. L. Bryan, of Columbia Terra Cotta Company and Ira A. Williams, Consulting Geologist, all former acquaintances of Mr. and Mrs. Purdy.

The second day, Thursday, October 16, was given to plant visitations in and about Portland. Among the factories visited were Standard Brick and Tile Company, through the courtesy of A. H. Wethey, Jr., President; Pacific Stoneware Co., T. S. Mann, President; Sewer-pipe Plant of Denny-Renton Clay and Coal Co., enameling department of the Portland Stove Works, and the plant of the Columbia Terra Cotta Company in Vancouver, Washington, owned and operated by M. L. Bryan.

Ira A. Williams, who has long been identified with the ceramic industries in both middle and western states, presided at the get-together dinner in the evening at the Multnomah Hotel. Mr. Purdy, in his customary apt and entertaining way, told of the growth and activities of the AMERICAN CERAMIC SOCIETY, and spoke of the needs of the industries which it represents. The desirability of conducting technical research along various ceramic lines was emphasized, and attention called to the importance and necessity of every one contributing freely of their own experience in the advancement of the business of the individual and of the ceramic industries as a whole.

The following persons were present at the dinner, eight of whom are members of the AMERICAN CERAMIC SOCIETY:

Mr. and Mrs. Ross C. Purdy, Columbus, Ohio
H. C. Elliott, Cascade China Company, Portland
Mr. and Mrs. M. L. Bryan, Columbia Terra Cotta Company, Vancouver, Wash.
Mr. and Mrs. T. S. Mann, Pacific Stoneware Company, Portland
Mr. and Mrs. A. H. Wethey, Jr., Standard Brick and Tile Company, Portland
F. J. Pohs, Portland Stove Works, Portland
Mr. and Mrs. H. R. Kreitzer, Columbia Brick Works, Portland
Mr. and Mrs. O. K. Edwards, Face Brick and Tile Mfr., Portland
Mr. and Mrs. J. E. Walling, Denny-Renton Clay and Coal Company, Portland
W. Foster Hidden, Common Brick Mfr., Vancouver, Wash.
Mr. and Mrs. L. A. Martin, Columbia Terra Cotta Company, Vancouver, Wash.,
L. E. Kern, Kern Clay Products Company, Portland
J. F. Straumford, Denny-Renton Clay and Coal Company, Portland
Miss Ersel Foron, Campbell Hill Hotel, Portland
Ira A. Williams, Consulting Geologist, Portland

MEETING OF ST. LOUIS SECTION[1]

A joint meeting of the St. Louis chapter of the American Institute of Architects, and the St. Louis Section of the AMERICAN CERAMIC SOCIETY was held at Washington University, Tuesday evening, October 28.

As usual, this was a dinner meeting and was held in the dining room at Washington University. The attendance of both Societies was evenly divided. The meeting was

[1] By F. E. Bausch, Chairman.

exceedingly interesting and enthusiastic. Wm. A. Hirsch, President of the St. Louis Chapter of American Institute of Architects presided and the various speakers of the evening were introduced by F. E. Bausch, Chairman of the St. Louis Section of the SOCIETY. Preceding the meeting, there was an inspection of an exhibition of polychrome and pulsichrome terra cotta by the two local terra cotta companies, namely, the St. Louis Terra Cotta Co., and the Winkel Terra Cotta Co.

W. T. Doyle, manager of the Terra Cotta Service Bureau of Chicago, made an excellent talk on the purpose of the Terra Cotta Service Bureau and its efforts in behalf of standardization of the work; also the promotion of a better understanding between the manufacturer and the user of terra cotta. An interesting discussion followed on this paper by some of the best known local architects, namely, Messrs. Mauran of Mauran, Russell, Crowell; Mr. LaBeaume and J. P. Jamieson, of the firm of architects who designed the buildings comprising the Washington University group. C. E. Klipstein who was on the program was not able to appear.

Prof. G. Ferrand, School of Architecture, made a very interesting talk on the splendid facilities and equipment of Washington University in connection with a comtemplated course in ceramics, inasmuch as the University has an exceptionally good chemistry department and a new building is just being erected for a geology department. The laboratory is well-equipped with machines for testing materials.

There are various industries established in St. Louis where also the raw materials are secured which would enable ceramic students to come into intimate contact with the commercial product.

November Meeting of St. Louis Section

The members of the St. Louis Section of the SOCIETY held their November meeting on the evening of November 25. A dinner was served preceding the meeting which was held at the American Annex Hotel. Among the papers was, "Something New in Enameling—Grained Mahogany" presented by E. Eizenbrot of the Buck Stove and Range Co., who displayed specimens of his work as illustrations. F. G. Jaeger, President of the Superior Enamel Products Company, talked on "How Porcelain Enamel Signs Are Made."

NOTES AND NEWS

PRESIDENT LANDRUM HONORED AT DINNER

On Monday night, November 3, R. A. Weaver, Editor of *The Enamelist* and President of the Ferro Enamel Supply Company, gave a dinner at the University Club of Cleveland, in honor of R. D. Landrum, Vice-President of the Vitreous Enameling Company of Cleveland and also President of the AMERICAN CERAMIC SOCIETY.

Everyone thoroughly enjoyed the dinner after which Mr. Landrum made a few remarks regarding the past and future of the enameling industry and pointed out that every year new fields were being opened to the enameling trade.

He pointed out that when he first entered the business as a chemist for the Lisk Manufacturing Company that the only field open at that time was the kitchenware field with some little business in the bathtub industry. Since then all kitchens have been completely enameled with such items as gas ranges, coal ranges, refrigerators, table tops; kitchen cabinets being largely finished in porcelain. Bathrooms are completely finished in porcelain and the next step is to use porcelain to a large degree in basements. This is

being done by such concerns as the American Radiator Company who are advertising very largely the idea of having heating equipment housed in porcelain.

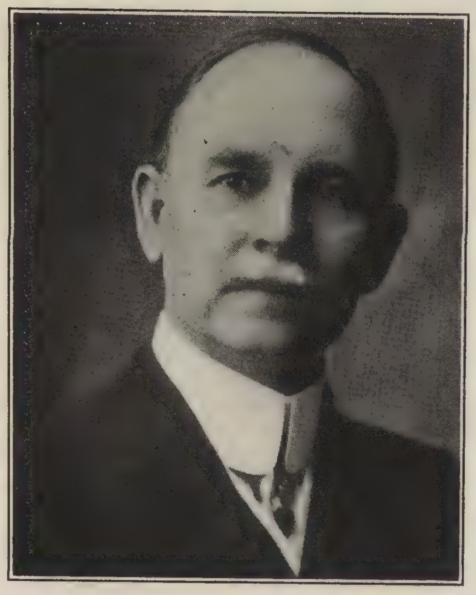
The following men who are interested in enameling were present at the dinner: R. D. Landrum and John Grainer from Vitreous Enameling Company, H. D. Cushman, J. D. Henry, H. C. Luebbert and R. L. Williams of the Ferro Enameling Company, Carl W. Mehling of The American Radiator Company of Buffalo, Paul Francais of The National Division of the American Stove Company, L. W. Manion of Canton, E. B. Prentice and H. F. Chrisman of The Massillon Refractories Company of Massillon, C. A. Blackburn and H. E. Barker of The Cleveland Metal Products Company, R. A. Weaver, H. E. Ebright, Paul Quay, H. L. Brooks, E. L. Stine, A. T. Davis, J. E. Rumer, Major Wilfred Mavor and R. A. Nelson of The Ferro Enamel Supply Company, H. E. Johnson of The Cincinnati Enameling Company, F. P. Allen of The Enamel Products Company, W. H. Wilson of The Lewis-Shepard Company, S. M. Jenkins of The Celite Products Company, F. G. Thorpe of The Brown Instrument Company, H. M. Richards of The American Rolling Mill Company and J. C. DeVol of The A. B. Stove Company.

After the dinner the entire crowd was entertained at the theatre, as guests of Mr. Weaver.

DEDICATION OF NEW CERAMICS BUILDING

Georgia School of Technology in Formal Opening

The first ceramic building south of the Ohio river was officially opened at Georgia Tech on Saturday morning, Nov. 15, when Prof. Watts, head of the ceramics department of Ohio State University, made his address on "Ceramic Resources in Georgia."



Dr. M. L. Brittain, Pres.
Formerly Supt. of Education of Ga. and Supt. of Public Schools of Atlanta.

The address was the outstanding feature of the exercises, followed by a luncheon given by M. L. Brittain to fifty prominent ceramic engineers of the south.

In addition to the ceramic experts of the south, many prominent educators were present. Among them was Chancellor Kirkland, of Vanderbilt University.

Course at Georgia Tech.

Ceramic instruction at Georgia Tech. was accomplished through support given the institution by the Atlanta Chamber of Commerce and Fulton County. Last year, under the leadership of George Carswell, President of the Senate, the Georgia legislature gave the school an annual maintenance fund of $10,000.

Courses of instruction at Georgia Tech cover a period of four years and lead to the degree of bachelor of science in ceramic engineering. A graduate of the department, according to A. V. Henry, in charge of the work at Tech must possess the basic knowledge which would enable him to prospect for raw materials and to carry them through the process of manufacture to the finished product.

The ceramics building is a one-and-a-half-story structure, 50 feet wide and 83 feet long, and is constructed of brick and terra cotta. It contains an office, library, classroom, testing laboratory, clay machinery room and kiln room.

Equipment of School

The testing laboratory is provided with balances, ball mills, molds, electric drier, electric oxidation furnace, a modulus of rupture testing machine and complete microscopic equipment.

In the clay machinery room may be found an emery wheel, jaw crusher, dry pan, pulverizer, rolls, auger machine, turning lathe, potter's wheel, jigger and complete

Fig. 2.—New Ceramics Building.

semi-commercial clay washer. The kiln room equipment consists of two experimental gas-fired kilns using induced draft, a pot furnace, a small muffle test furnace, a gas-fired drier, potentiometers and recording pyrometer.

Completion of the new building by the state of Georgia will enable students to combine the theoretical and practical aspects of ceramic engineering. Georgia contains vast beds of ceramic materials, including clays, kaolins, bauxites, feldspars, sands, cement rock and fullers' earth, and special inspection trips have been arranged by the department for juniors and seniors.

A. F. Greaves-Walker, head of the department of ceramic engineering, North Carolina State College, represented the American Ceramic Society at this meeting.

ADDRESS BY A. S. WATTS, AT DEDICATION OF NEW CERAMICS DEPARTMENT BUILDING

Prof. Watts in part said that a fair return on the investment may rightfully be expected from this school. A department of ceramics is especially unfortunate or fortu-

nate, according to viewpoint, because it has so many fields in which its service may be helpful. According to the various viewpoints it must solve ceramic problems, improve processes, lower cost of production, find new materials, improve products and train men to be superintendents and managers. It would be false to expect in a four-year course of instruction, to train men to be accomplished in all these things. The school must furnish the training as best it can and pass the men to the industries for completion of their education.

Before a young man can become useful industrially he must acquire industrial vision through direct contact with industry. He who accepts a position of responsibility without this vision and with only a theoretical education is courting disappointment.

Ceramic industries need men who can apply science fundamentals to problems of plant control and production.

The greatest drawbacks to progress in the ceramic industries are tradition and misunderstanding. The solution is coöperation between the schools and the manufacturers in providing for and requiring plant experience in the summer periods while the ceramic student is in school.

The ceramic resources of Georgia are many and varied: surface clays for common brick, hollow block, drain tile and sewer pipe; white clays and fluxing materials for face brick; and refractory clays for refractories. The white brick may be salt glazed. Terra cotta and sanitary ware may be made here and also glass. Pottery and faience tile are possible here. All of these require development of the sort in which a department of ceramics may be helpful. It requires more than raw materials. It must have proper buildings, equipment, processing, factory control and trained artisans.

The ceramic school will train men to explore the ceramic material resources of the state, to determine the methods and mixtures. They will be trained in ceramic processing. But this school should not attempt the training of artisans. Technical schools should not be made into trade schools nor trade schools into technical schools.

Manufacturers should establish fellowships here for the conducting of researches under the joint direction of the instructors and the manufacturers. Under such arrangements the student would receive a salary of about three hundred dollars from the manufacturer. This has served to (1) increase information; (2) give the student valuable industrial contact; (3) enable him to complete his education on money earned; and (4) enable the employer to determine the availability of the student for usefulness in his organization.

In closing Prof. Watts outlined ten specific endeavors the doing of even a few of which he averred would amply repay the investment here begun.

REPORT OF PROF. GREAVES-WALKER ON GEORGIA TECH DEDICATION

There were only fifty invitations issued and practically every one was accepted. The guests consisted principally of the clayworkers of Georgia and others interested in ceramics in the state who had made donations of money and materials that made the building possible. North Carolina State, Alabama Poly and University of Alabama were the colleges represented.

Due to the funeral of Dean Emerson of Tech which was held in the morning, the ceremonies were delayed an hour and a half and were therefore limited to the speech of Prof. A. S. Watts, the speaker of the day. Prof. Watts was introduced by President Brittain who in a few short remarks gave the history of the creation of the department

and told of the help received from the industries of the state. Prof. Watts' speech was interesting and enthusiastically received. President Downs of the Central of Georgia Ry. and Lieut.-Governor Carswell were then called on for a few remarks after which the guests were entertained at luncheon by President Brittain.

After lunch the guests were taken to Grant Field to witness the football game between Tech and Vanderbilt as guests of the Tech faculty. This ended the program.

The new department has a fine building and splendid equipment. The building is one story and basement, built of red brick donated by the Stephenson Co., Birmingham, Ala. It has a white stone trim and a tile roof. The roofing tile were donated by B. Mifflin Hood, Atlanta. All of the rooms and halls are floored with tile and wainscoted with the same material. The tile were also donated by Hood. In the furnace room are two down-draft, gas-fired test kilns and a load furnace. On the same floor is also located the office, a classroom, a library and two laboratory rooms.

In the basement is the heavy equipment consisting of auger machine, cutter, pan, small crushers, clay washing plant, filter press and potters wheel. Taken altogether, Tech has a promising start.

NECROLOGY

Otto W. Will

Otto W. Will, Superintendent of the ceramic color department of the Roessler and Hasslacher Chemical Company of Perth Amboy, N. J. and member of the AMERICAN CERAMIC SOCIETY since 1919, died on October 30, 1924. Mr. Will was born at Braubach a/Rhein, Dec. 25, 1868 and came to America in 1888. His early education and preparatory work for taking up the medical profession was completed in Germany. In 1891 he took up his work with The Roessler and Hasslacher Co., where he remained until his death. He is survived by his widow, four sons and two brothers.

OTTO W. WILL

FURTHER NOTES ON CERAMIC SCHOOLS[1]

North Carolina State College

North Carolina State College which has organized a Department of Ceramic Engineering under the leadership of Prof. Greaves-Walker reports the following class enrollment for this year: 4 Freshmen, 2 Sophomores, 1 Junior and 1 Senior. The Freshmen and Sophomores are registered for Ceramic Engineering and will get their first ceramic work next year. The Juniors will get their degrees in the department in which they originally registered but will take what ceramic courses they can substitute in the Senior year. Two Seniors are getting what ceramics they can by working 12 hours per week on two research problems that are being carried on by the department. This is in addition to their regular senior work. These students are either registered in the department or are taking all of the ceramic work which can be offered this year

[1] See "Notes on Ceramic Schools," *Bull.* **3** [11] 458–60.

preparatory to going into the industry. A description of the correspondence course in ceramic engineering at North Carolina State College follows on page 474.—By PROF. A. F. GREAVES-WALKER, Head of Department of Ceramic Engineering.

The University of North Dakota

The primary object of the ceramic department of the University of North Dakota is to aid in research work on the high grade clays of the state. For economic and technical reasons this research work was coupled with that of instruction, thereby utilizing the equipment, the laboratories, the technical force and the work of advanced students in both the educational and research problems.

No special degree is given in ceramic engineering, but students in mining and industrial engineering, and in other lines, are given an opportunity to take some of these technical studies as ceramic electives. The work offered in connection with the ceramic department covers two years. The enrollment is limited to sixty which is as many as can be efficiently handled in connection with the research work and present facilities and staff.—By MARGARET K. CABLE, Asst. Professor of Ceramics.

Newcomb School of Art

	1923–24	1924–25
Total	25	28
Ceramic Decoration	3	11
Making of Pottery and Glaze, Firing	22	17

Seniors: Edith Hohn, Juanita Gonzales Graduate: Elizabeth Davis, Phyllis Reeves. —By MARY G. SHEERER, Professor of Ceramic Decoration.

NORTH CAROLINA STATE COLLEGE OFFERS CORRESPONDENCE COURSES IN CERAMIC ENGINEERING

New Department of Ceramic Engineering to Pioneer in This Field

In accordance with its purpose to be of the utmost service to the industries of the state and country, North Carolina State College through the College Extension Department has decided to add Ceramic Engineering to its correspondence courses. These courses will carry college credits.

With the knowledge that very little has been done for the growing ceramic industries of the state and that there are a great number of clayworkers in North Carolina and the rest of the country who are desirous of broadening their knowledge of the technical side of ceramics, but have little opportunity to do so, the new Department of Ceramic Engineering, under the direction of Professor A. F. Greaves-Walker, is planning to reach and assist the practical man in every way possible. Realizing that graduates of the department will not be available for four years and will then require practical training before being of any great value to the industries of the state, an Extension program for the clayworker has been laid out which includes a week's instruction in clayworking and ceramics each year and the correspondence courses. These are open to the clayworkers of the entire country.

The correspondence courses to be offered with the credits given are as follows:

1. History of Ceramics (1 credit)
2. Physical Geology (2 credits)
3. Occurrence and Properties of Clays (3 credits)

4. Mining and Preparation of Ceramic Materials (3 credits)
5. Explosives (1 credit)
6. Forming Ceramic Wares (2 credits)
7. Driers and Drying (3 credits)
8. Kilns and Burning (3 credits)
9. Setting Heavy Clay Products (1 credit)
10. Ceramic Calculations (3 credits)
11. Ceramic Designing (3 credits)
12. Feldspars and Kaolins (2 credits)
13. Refractories and Furnaces (2 credits)
14. Pyrometry (1 credit)

As the courses are designed primarily for the present needs of the clayworkers and miners of North Carolina, they will include, for the present, instruction covering heavy clay products only. Other courses may be added later as the need and demand appears.

It is expected that Courses 7, covering Driers and Drying, and 8, covering Kilns and Burning, will be ready in late December or early January. The other courses will be given as a sufficient number of students register for them.

The fees will be based upon the credits given for the completion of each course, two dollars and a half per credit being charged. Thus a three-credit course will carry a fee of seven dollars and fifty cents.

A bulletin describing these courses as well as those offered by other departments of North Carolina State College has been issued and may be had upon application.

NORTH CAROLINA CLAYWORKERS ORGANIZE

At an enthusiastic two-day session held during the week of Nov. 9, 1924, at the Vance Hotel, Statesville, N. C., the clayworkers of the state perfected a permanent organization to be known as the North Carolina Clayworkers Association.

The objects of the Association are educational, the principal ones being: the improvement of plant processes and products, the dissemination of information regarding clay products, and the advancement of the Department of Ceramic Engineering at North Carolina State College.

The officers elected were: President, Frank Daniels, Goldsboro; 1st Vice-President, N. B. Kendrick, Mt. Holly; 2nd Vice-President, J. D. Johnson, Raleigh; Secretary-Treasurer, Prof. A. F. Greaves-Walker, State College, Raleigh; Member Executive Committee, George M. Norwood, Raleigh.

Committees were appointed on freight rates, membership, trade schools, and advancement of Department of Ceramic Engineering, State College.

A committee to act in an advisory capacity to the Department of Ceramic Engineering, composed of Frank R. Daniels, T. H. Holmes, and George M. Norwood, was also appointed.

Prof. Greaves-Walker made a preliminary report on the clay, shale and kaolin resources of the state and predicted an era of ceramic development in the Piedmont region in the immediate future. He also announced that State College would offer a short course in Clayworking and Ceramics, January 12–16, 1925, and was now offering correspondence courses in fourteen ceramic engineering subjects. This is the first time ceramic engineering subjects have ever been offered by correspondence.

Theodore A. Randall, for thirty-nine years Secretary of the National Brickmakers

Association, with headquarters at Indianapolis, Ind., was among the guests at the convention.

The next quarterly meeting of the Association will be held in Raleigh, during the week of January 12, 1925.

SHORT COURSE IN CERAMICS AT NEWELL, W. VA.

The second year of ceramic instruction at the Newell High School was begun with the initial session held on Thursday, November 6. The classes as before are arranged for Monday and Thursday, from 7.30 till 9 P.M. The work has made a good beginning with 40 registered students.

The courses given are as follows: Shop Arithmetic and Shop Mechanics, by R. V. Miller; Principles of Ceramics and Ceramic Problems, by J. W. Hepplewhite; Heat and Heat Measurement, by V. J. Roehm; Principles of Economics, by Lester M. Aaron. The instructors are all connected with potteries of this district. Mr. Miller is ceramic chemist with the Knowles, Taylor and Knowles Pottery Co. of East Liverpool, Mr. Hepplewhite is with the E. M. Knowles China Co. of Newell, Mr. Roehm with plant No. 6 of the Homer Laughlin China Co. and Mr. Aaron with plant No. 4 of the same company. With the exception of the last named instructor these men are graduates of Ohio State University. Mr. Aaron is a graduate of Princeton and Harvard.

Much credit is due these men for the work they are doing which involves considerable sacrifice in time and labor. It is a most encouraging sign, however, that the course has the earnest support of the Brotherhood of Operative Potters. The duration of the course is 18 weeks.

EXHIBITS OF CLAY WORKING MACHINERY

The Common Brick Manufacturers Association is providing opportunity in connection with their annual meeting, Drake Hotel, Chicago, February 9–13 for an exhibit of clayworking machinery and supplies. This is the week prior to the Annual Meeting of the AMERICAN CERAMIC SOCIETY in celebration of the world's first collegiate department of ceramic engineering, Columbus, Ohio. There is coöperation between these two organizations to make these exhibits educational in the most effective way.

SOCIETY OF GLASS TECHNOLOGY

The first meeting of the Society of Glass Technology for the session 1924–25 was held in Sheffield on October 15, the President, Col. S. C. Halse, in the chair. An address entitled, "The Present Position of the Glass Industry in North America," was given by W. E. S. Turner, who observed that in America the period of trade depression had not been continuous, as was the case in the United Kingdom. In the autumn of 1922, American trade began to improve, and 1923 was a very good year. In February, 1922, trade in general began to fall off, and a very dull period still persisted.

The cut glass industry had almost entirely died out in America, but colored glass was finding a place more and more. There was a distinct improvement in American taste for glassware. At the Steuben works of the Corning Glass Company some very fine artistic work was being manufactured.

Prof. Turner next referred to the gradual disappearance of pot furnaces in favor of tank furnaces. The latter were now being used even for the manufacture of green and

blue signal lights, and for selenium ruby glass. Electric light bulbs, except in the case of very small or very large bulbs, were now practically all made by machines fed from tank furnaces, the glass being the soda-lime-magnesia type. The tubing required for the completion of the lamp was still of the glass variety.

Several noteworthy advances in the glass industry were then noted. During the past few years there had been a very distinct development in the use of blowing machines or press and blow machines. In this connection reference was made to (1) the Westlake Machine for thin walled tumblers, (2) The Hartford-Empire Machine for electric light bulbs, and (3) the great development in the manufacture of light walled tumblers.

Dealing next with sheet glass, Prof. Turner remarked that the Fourcault process had not as yet achieved any considerable success in America. The cylinder process was still in active operation. An epoch-making operation was that developed at the glass works of the Ford Motor Company. This process marked an absolute departure of the use of pot furnace, as the glass was melted in tanks and there was continuous rolling between a pair of rollers, the sheet passing down a leer about 440 feet long and subsequently, in sheets, traversed long tables in a continuous belt, where the grinding and polishing were done.

With regard to bottle machine there was a tendency to replace the Owens machine in favor of the feeder-fed type. There were no striking advances in feeding devices, the Hartford-Empire Feeder being the most in favor, followed by the W. J. Miller. One novelty in operation was the use of a rotating plunger, especially when large ware was being made.

Prof. Turner then dealt with the problems of furnaces and furnace efficiency. This was one of the foremost problems discussed by glass manufacturers. The average life of a tank furnace operated by machines was 11 to 13 months. A table was presented showing for a number of factories the value of the ratio of fuel consumed to glass melted. Several factories could show a ratio as low as 0.6. In conclusion reference was made to the innovation of the use of heatless leers. A description was given of such leers.

BUREAU OF MINES NOTES

Dolomite for Refractories

The dolomite refractories investigation being conducted by the Department of the Interior at the Ceramic Experiment Station of the Bureau of Mines, Columbus, Ohio, includes a study of the many fluxes which could be used to aid in the dead-burning of dolomite and also a complete survey of the iron oxide-alumina-silica field as fluxes. The temperature of calcination and the resulting properties have been carefully investigated, and the most desirable calcines chosen for further investigation in the making of dolomite brick. Many binders and the several methods in common use of fabricating brick commercially have been tried, and a thorough study has been made of the properties of the most successful ware.

The results of the work of the Bureau of Mines investigators indicate that by employing the proper fluxes in the proper proportions, it is possible to dead-burn dolomite, when properly sized and under proper heat treatment, to a grain that will not slake after long exposure to the air or under the more severe autoclave treatment. Several binders for the ground grains have been found to give promise while two of this number are especially satisfactory. It is possible to make shapes from ground sinter, by both the semi-dry press and slop mold methods, which, when properly fired, will not slake upon prolonged exposure to the weather. The brick thus made have physical properties which indicate that they will probably give good service as a basic refractory.

Details of these investigations looking toward the utilization of dolomite for refractories are given in Serial 2627 by G. A. Bole, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

NOTES FROM THE BUREAU OF STANDARDS

The Strength of Hollow Tile and Reinforced Concrete Floor Slabs

The Bureau of Standards, in coöperation with the Hollow Building Tile Association, recently completed a series of tests on specimens of combination hollow tile and reinforced concrete floor slabs, reinforced in but one direction. The tests were planned to determine the extent to which the tile could be relied upon in resisting bending and shearing stresses.

Forty-four slabs, varying from 8 ft. 10 in. to 15 ft. in length, with a total depth of 8 in., and a maximum width of 30 in. were tested. The combination slabs consisted of two 4-in. concrete ribs separated by a single row of tile, laid with their cells parallel to the length of the slabs, and enclosed on each side by a row of tile sections which had been cut to include nearly one-half their original width. In some of these slabs 8 by 12 in. tile were used without a topping, and in others 6 by 12 by 12 in. tile were laid and covered by a 2 in. concrete topping. For comparison 2 in. solid concrete slabs having the same gross sectional area as the composite slabs, and 3 in. solid concrete beams having the same sectional area as the area of the concrete ribs in the composite slabs were tested. A greater amount of tensile reinforcement was used than is ordinarily employed in practice in order to prevent the failure of the steel before high stresses in the concrete and tile had been developed.

The specimens were tested in a vertical-screw beam-testing machine having a capacity of 600,000 pounds. The deformations in the concrete, tile and steel, and the deflections of the slabs were measured as the loads were applied. By changing the positions of the loads, bending and shearing stresses several times greater than working stresses for concrete were developed.

It was found that the bond between the concrete and tile was sufficient to cause the tile to assist materially in resisting both bending and shearing stresses. The value of the tile in beams without a concrete topping was almost directly proportional to the modulus of elasticity of the tile. When medium or hard tile are used, it appears that the shells of the tile which are in contact with the concrete are as effective as an equal width of concrete would be. A report on these tests is now being prepared for publication.

Method for Evaluating the Different Qualities of Clays

The elementary chemical analyses of all clays show the same constituents, but in widely varying proportions. These differences have failed to account for variations in color (raw and fired), working properties, plasticity, absorption, adhesiveness, and refractoriness.

The Bureau of Standards has undertaken the study of clay colloids, into which a part of all the ultimate elements of the clay body enter, by subjecting a standard, commercial, washed white paper and pottery clay, long known for relative uniformity in its properties, to the action of leaching and dispersion with water and dilute reagents to which it may be subjected in its various uses. It has been separated into fractions of relatively greater and less concentration of absorbed basic elements, and into fractions of greater and less colloid content, and of coarser and finer granular composition.

These divisions are to be subjected to all practical tests capable of quantitative evaluation in comparison with the original. It is believed that by a comparative study of the clay with its own definitely controlled modifications and derivatives, increasing and decreasing its plasticity, supsension power, absorption, color and fire behavior, information will be obtained that will be applicable to all other clays and which will lead to new analytical methods for evaluating the different qualities of clays.

Drying Properties of Clays

The Bureau's preliminary work on the investigation of the drying properties of clays has been completed and a report which will include a discussion of the factors affecting the satisfactory drying of clay wares is now being prepared for publication. Lovejoy's classification of clays is used approximately, and successful drying is shown to be a function of the character of the clay and of the rate of drying, involving as factors temperature and humidity of both air and clay, and also size and shape of the clay body. The causes of the various types of drying injuries are also pointed out.

As a result of observations made, the following method is suggested for working out a rapid and safe drying schedule for each type of clay: Successive groups of samples of the particular type of clay under consideration are dried, each group at a rate more rapid than that used in the preceding group. This is continued until the most rapid possible drying rate has been determined, beyond which rate any increase in the temperature or rate of drying results in an excessive and intolerably large percentage of drying injuries to the ware.

Frequent observations of shrinkage during such trials have shown: First, that cessation of drying shrinkage takes place comparatively early in the drying process, and is practically coincident with the completion of the evaporation of the so-called "free water;" second, that after this stage is reached, the drying may be hastened almost as much as desired, so long as baking temperatures are not reached, without appreciably adding to the percentage of drying injuries.

New Method for Bonding Magnesia Refractories

The Bureau's preliminary work with magnesia refractories has indicated a promising method of bonding electrically fused magnesia which will be used in making the first experimental lining for the Bureau's new Detroit electric furnace for steel melting. Eighty-mesh fused magnesia bonded with approximately 20% water-ground fused magnesia burns at 1500 to 1600°C to a satisfactory strength and if properly applied may be used as a firmly adhering facing over commercial magnesite brick.

Ground Coat and White Cover Enamels for Sheet Iron and Steel

An investigation of the relative values of feldspar and quartz as the refractory in white cover enamels for sheet iron and steel has recently been completed. This work was undertaken to determine the effect produced by substituting feldspar for quartz, and quartz for feldspar in commercial types of enamels.

The report on the work which is being prepared for publication will contain the results obtained with three groups of twenty enamels each, in which feldspar-quartz ratios were 60:0, 35:25, and 0:60, the other constituents being changed in quantity and kind. The results indicated in general that: First, increasing the quartz reduced opacity of the enamels, increased their resistance to thermal shock and to action of acid, but produced no marked change in their mechanical strength; second, the effects of increasing the feldspar were not as pronounced as in the former case, but it may be said that a slight decrease in opacity, resistance to acid and thermal shock, and mechanical strength was obtained.

JOHN L. HARPER, THE ENGINEERING GENIUS OF NIAGARA FALLS POWER COMPANY, CALLED BY DEATH

John Lyell Harper, vice-president and chief engineer of the Niagara Falls Power Company, died November 28th. He underwent an operation for appendicitis, but his heart was unable to withstand the rigors of the malady.

An Engineering Genius.—Recognized as one of the greatest of the world's hydro-electric engineering geniuses, Mr. Harper was responsible to a large extent for the development of the Niagara Falls Power Co. He was associated with that concern and its predecessor, the Hydraulic Power & Manufacturing Co., for 22 years, starting in the company's employ as an assistant engineer. He designed and constructed the eleven million dollar extension of the company's mammoth plant which was completed recently and which will remain a monument to his ability as a hydro-electric genius. He also designed other big development works of the company.

Mr. Harper was 51 years old, having been born in Harpersfield, Delaware county, New York, September 21, 1873. He was vice-president and chief engineer of the Harper-Taylor Company, consulting engineers recently organized and in which the Cramps Shipbuilding Company is heavily interested.

J. L. Harper

Mr. Harper was prominently identified in the membership of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Electrochemical Society, the American Ceramic Society and the Engineers' Club of New York City.

Four years at Cornell University brought his degree in Mechanical Engineering and in 1898, one year after graduation, he married. His career was marked by the simple progression that stamps the lives of all mortals who achieve the real things in life. He was in charge of the design and of the construction of Hydraulic Station No. 3-A in the gorge below the Falls. In the long stretch of years from 1902 until 1918 under his engineering direction the installed capacity of the great gorge plants grew from 14,000 to 160,000 horse power. During the year 1918 the various power interests were grouped under government direction into a new corporation taking the name of the Niagara Falls Power Company, and Mr. Harper was made its chief engineer.

During the war when there was a serious shortage of power at Niagara Falls and the War Department requested plans for the most economical development to utilize the remaining water available for diversion, it was the Harper plan that met with the approval of the government.

It has been said, and rightly too, that genius is the capacity for taking infinite pains. Such a one was John Lyell Harper. His imagination and his foresight were astonishing. He seemed always to be ready when the time of action came. It is some slight consolation to those who shared his labors that he saw the completion of the latest power plants for they are the children of his mastermind.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924–Jan. 3, 1925	Washington, D. C.
Am. Assn. of Flint and Lime Glass Mfrs. (Annual Meeting)	July, 1925	Atlantic City, N. J.
Am. Soc. for Testing Materials	June 22–26	Atlantic City, N. J.
Am. Concrete Institute	Feb. 24–27, 1925	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
The American Institute	Dec., 1924	New York City
Am. Inst. of Chemical Engrs.	Dec. 3–6, 1924	Pittsburgh, Pa.
Am. Society of Mech. Engrs.	Dec. 1–4, 1924	New York City
Common Brick Mfrs. Assn.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Exposition of Inventions	Dec. 8–13, 1924	New York City
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Manufacturing Chemists' Assn.	June, 1925	New York City
Mining & Met. Society of America	Jan. 13, 1925	New York City
Natl. Assn. of Mfrs.	May, 1925	New York City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Brick Mfrs. Assn.	Jan. 26–31	Washington, D. C.
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Exposition of Power & Mech. Engrs.	Dec. 1–6, 1924	New York City
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
National Lime Association	May, 1925 (?)	
N. J. Clayworkers' Assn. and E. Sec. of the AMERICAN CERAMIC SOCIETY	Dec. 19, 1924	New Brunswick, N. J.
Taylor Society	Dec. 4–6, 1924	New York City
Tenth Exposition of Chem. Industries	Sept. 28–Oct. 3, 1925	New York City
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Mfrs. Assn.	Jan., 1925	Kansas City, Mo.

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James W. Moncrief,* 230 Sonoma Ave., Stockton, Calif.
Harry A. Montag,* 883 Commercial St., Portland, Ore.—E.

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L. J. Munroe, Esq.,* 912 Colborne St., London, Ont., Canada.—E.
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